



INTERNATIONAL SOIL CONFERENCE NEW ZEALAND 1962



INTERNATIONAL SOIL CONFERENCE NEW ZEALAND, 1962

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All correspondence should be addressed to:

The Secretary-General,
International Soil Conference,
P.O. Box 8001,
WELLINGTON, New Zealand.

Cable Address: Research: Soils
Please use air mail.

NOTE: *This communication supersedes all previous announcements.*

NEW ZEALAND JOURNAL

(Including short stops in
Hawaii and Tahiti)

(October 24 to November 26)

Charles E. Kellogg

1962

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some rain. At Palmerston North mean minimum and maximum temperatures for November are 52°F (11°C) and 70°F (21°C) respectively. However, since the tours cover most of the country, a fairly wide range of climatic conditions can be expected.

Clothing: For use on the tours, medium-weight woollen clothing, a light waterproof raincoat, and boots or overshoes are suggested. Formal evening dress will not be required for any of the Conference functions.

Membership: Membership of the Conference is open to scientists working in fields related to soils. Wives and families will be welcome, and special entertainment is being arranged for them.

Registration Fee: The Registration Fee for full members will be £(N.Z.)9 (\$25). This will include admission to all Conference Functions, and fares for short excursions (*excluding* Pre- and Post-Meeting Tours). It will also entitle the member to a copy of the published Proceedings.

There will be no additional registration fee for wives of members.

Language: English will be the official language of the Conference and no provision will be made for multilingual translation or for printing of papers in other languages. It would be an advantage therefore, if members were reasonably familiar with the English language.

Proceedings: All papers accepted for inclusion in the programme will be included in the Proceedings, which will be published following the Conference. Provided papers are received in time, they will be pre-printed before the Conference.

Papers must conform to the requirements set out under "Programme" (p. 12), and should be received by 1 March 1962 to facilitate pre-publication.

Summaries of the Discussions will be included in the Proceedings.

Exhibits: An extensive range of exhibits illustrating New Zealand soils, agriculture and forestry, is being prepared for display at the meeting. It is hoped also to display a collection of monoliths of soils from different parts of the world, and the cooperation of members of the International Society of Soil Science is being enlisted in this undertaking. Offers of soil monoliths from other countries will be gratefully received. Exhibits by commercial firms, farming organisations, and the agricultural aviation industry, will also be featured.

New Zealand Grasslands Association—1962 Conference: The 1962 Conference of the New Zealand Grasslands Association will be held near the time of the International Soil Conference. Further information will be announced later. The Association will be pleased to welcome overseas visitors to this meeting and those interested are cordially invited to write to: The Secretary, C/o Department of Agriculture, WELLINGTON.

Shopping, Banking and Postal Facilities: A Post Office is established at Massey College. Banking facilities will also be available during the Meeting. Palmerston North, a city of some 40,000 people, offers a good range of shopping facilities.

Tourist Attractions: New Zealand is well known for its scenic and sporting attractions. Visitors wishing to obtain further information should get in touch with their local travel agencies, or apply direct to the Government Tourist and Publicity Department, Wellington, New Zealand. It is hoped to have a representative of the Tourist Department in attendance at the meeting.

All correspondence should be addressed to: The Secretary-General, International Soil Conference, P.O. Box 8001, WELLINGTON, New Zealand. PLEASE USE AIR MAIL. *Cable Address:* Research: Soils.

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SOUTH ISLAND



NEW ZEALAND JOURNAL

1962

At the Paris Congress of the International Society of Soil Science, 1956, it was suggested that a joint meeting of Commission IV on Soil Fertility and Plant Nutrition and of Commission V on Soil Genesis, Classification, and Cartography, be held in New Zealand in 1962. This suggestion was confirmed and approved at the Seventh International Congress in Madison in 1960 with the acceptance of the New Zealand invitation. New Zealand has been strong in both of these fields and the greatest need in Southeast Asia is for soil surveys and for research and demonstrations in soil fertility management.

Last spring it was decided that three of us from the Soil Survey could attend, provided all went by economy-class transport. Besides myself, Mr. William M. Johnson, Principal Soil Correlator, Western States, and Mr. J. M. Williams, State Soil Scientist, Hawaii, were authorized to attend. Plans were made for Professor René Tavernier and Professor R. Marechal of the University of Ghent to come to Washington a few days in advance of my departure. Then we would pick up Johnson and Williams on the way and go to the International Conference by way of Tahiti. All the others planned to take

field trips both before and after the Conference. But since I had seen the North Island some in 1949, we planned to stay together for the South Island tour before the Conference. The others would stay together for the North Island tour while I returned to Washington.

This Journal is an account of my observations as taken down in notes on the spot. Many of these notes were taken in great haste and some may be inaccurate. Certain tentative conclusions may be changed.

Readers of this Journal are not to quote material from it for publication without permission in writing.

Besides the photographs included with the text of these notes, some kodachrome transparencies are on file.

Western States and take part in the discussion about the work for improving our system of classification with special reference to the economy of soil description, series definitions, and the use of the system for interpretations needed by soil users.

We are back to the hotel for an early dinner. I am early to bed while Tavernier and Marshall take a walk in San Francisco.

October 24: Mommy takes Professor Tavernier and me to the Baltimore airport where we meet Marechal. Today there is considerable tension between the United States and the Soviet Union over arms in Cuba. The President of the United States has just ordered the Navy and the Air Force to stop and search all planes and ships and to remove any "offensive" weapons. Since the Soviets have a fleet of ships on the way some trouble could result.

We leave by United Airlines jet plane at 9:00 a.m. and are down in San Francisco about 11:45 a.m. Bill Johnson meets us and takes us to the Hotel Californian. We stay just long enough to check in and then go out to Berkeley. There we meet with the soil correlators of the Western States and take part in the discussion about the work for improving our system of classification with special reference to the accuracy of soil descriptions, series definitions, and the use of the system for interpretations needed by soil users.

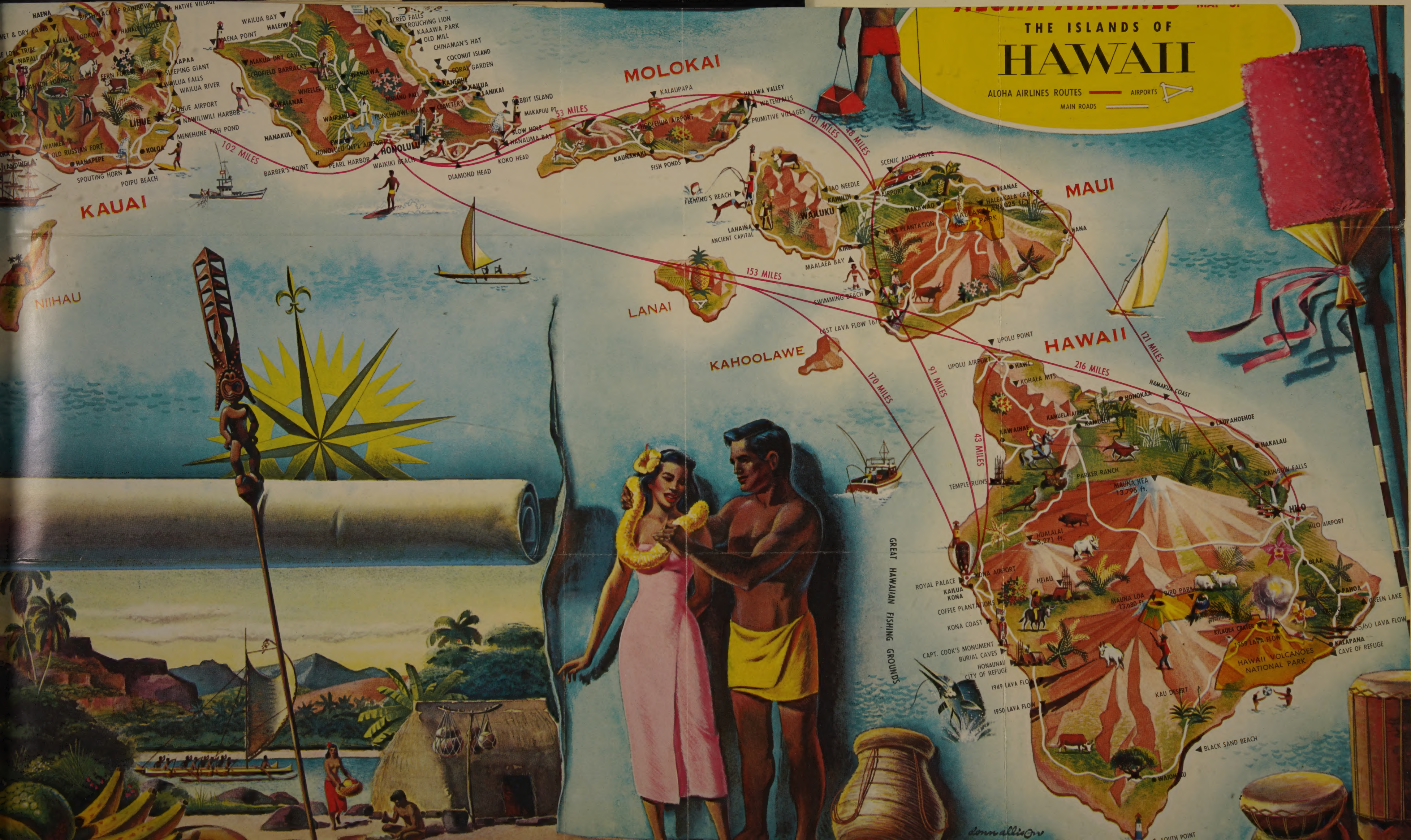
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October 25: I am up for breakfast at 6:30. We pack and go to the city air station and take the bus to the airport where we meet Bill Johnson. We leave on a Pan American jet for Honolulu at 10:00 a.m. The plane is completely full. Although this is good for the stockholders, the passengers are a bit squeezed. We arrive in Honolulu nearly on schedule at 12:00 noon (which is 6:00 p.m. EDT in Washington).

Here we are met by J. Mel Williams, State Soil Scientist and Mr. Robert Brown, State Conservationist, Hawaii. So now we are six. We change to Aloha Airline and leave for the Island of Maui at 1:30 p.m. Brown emphasizes to me the need to make a stronger case for the laboratory and research items of the Soil Survey. He thinks those funds are equally important to those for field mapping and correlation. We arrive at the Kahului Airport about 2:10 p.m. We are met by Mr. R. C. Malmgren, Soil Scientist for Maui County, who arranges transport to the Maui Palms Hotel. We quickly change into field clothes and drive northwest of the city to a high hill (K-3004; K-3005) where we look at the Naiwa series,

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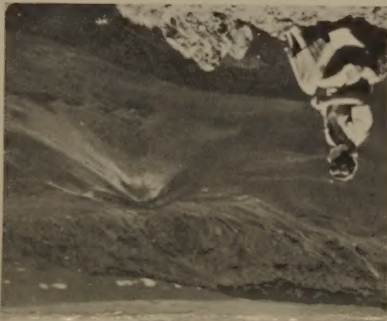


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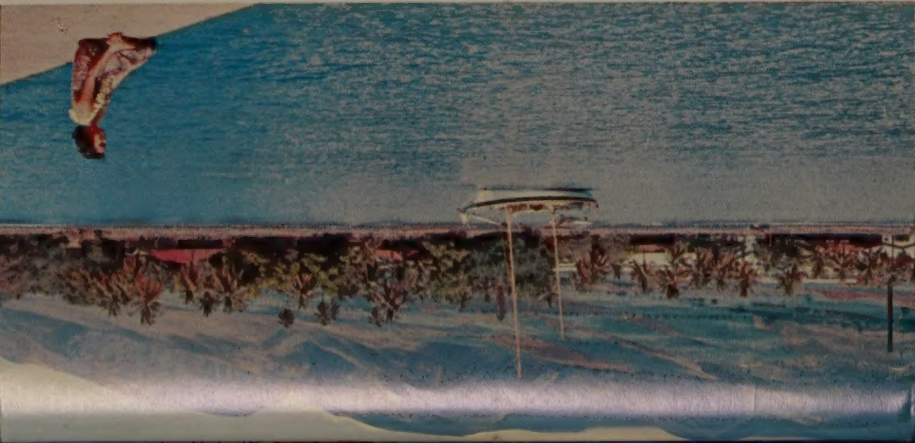
Maui's Haleakala Crater

MOLOKAI is the Friendly Island

Maui takes its name from the ancient Hawaiian demi-god Maui. It boasts a spectacular coastline which ranges from golden sands to precipitous cliffs and deep-cleft valleys such as Iao Valley, with storied Iao Needle. Haleakala, an impressively formed dormant volcano, is Maui's highest elevation and one of the Islands' chief sights. Its summit crater towers 10,025 feet above the sea, is 3,000 feet deep and 20 miles from rim to rim. Before the capital of Hawaii was moved to Honolulu in 1845, sleepy Lahaina, on Maui, was the capital of the Hawaiian Kingdom. It was in Lahaina also that whaling fleets of old wintered to make it the whaling capital of the Pacific, and the landmark it still is.

Area: 728 square miles. Population: 35,717. Principal town: Wailuku. Distance from Honolulu: 70 miles.

Historic Lahaina and West Maui mountains.



Sleeping Giant, one of many scenic wonders on Kauai.

Maui is the Valley Island. Maui takes its name from the ancient Hawaiian demi-god Maui. It boasts a spectacular coastline which ranges from golden sands to precipitous cliffs and deep-cleft valleys such as Iao Valley, with storied Iao Needle. Haleakala, an impressively formed dormant volcano, is Maui's highest elevation and one of the Islands' chief sights. Its summit crater towers 10,025 feet above the sea, is 3,000 feet deep and 20 miles from rim to rim. Before the capital of Hawaii was moved to Honolulu in 1845, sleepy Lahaina, on Maui, was the capital of the Hawaiian Kingdom. It was in Lahaina also that whaling fleets of old wintered to make it the whaling capital of the Pacific, and the landmark it still is.

Area: 555 square miles. Population: 27,922. Principal town: Lihue. Distance from Honolulu: 90 miles.

KAUAI is the Garden Island

Beach scene on the Garden Island of Kauai.





KAUAI



OAHU



MOLOKAI



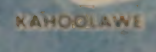
MAUI



HAWAII



LANAI



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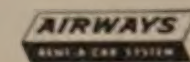


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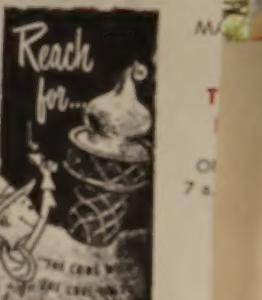
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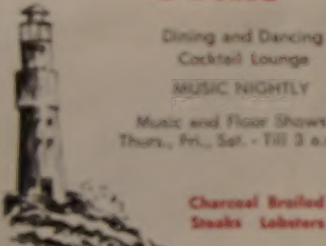
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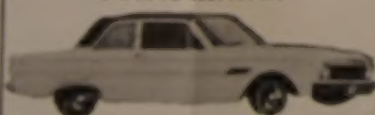
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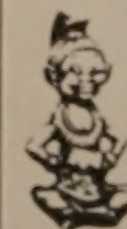
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- 17 - 22" Red (10R 4/6) clay loam, a bit less firm than the above.
- 22 - 34" Dark red (10R 3/7) very friable loam to clay loam.
- 34"+ Like the above but mixed with fragments of partially weathered andesite.

The surface granules easily cling to the magnet.

The roots of kikuyu grass go deeper than 34 inches.

The pH is said to be about 5.0 above 2 feet and about 4.6 below that. The cation exchange capacity is about 20 in the upper part and rises to 89 in the lower part.

^{1/} Throughout this trip it simply is not possible for me to make detailed soil descriptions in the time available and with large groups of people about. Very good descriptions are on record for all the soils of Hawaii and fairly good ones are available in the New Zealand Guidebook.



K-3004 October 25, 1962. Hawaii. Maui, looking toward Kahului Harbor. Standing on Naiwa series - a Humic Ferrugineous Latosol.



K-3005 October 25, 1962. Hawaii. Maui, looking toward Kahului Harbor site of Naiwa series. (Tavernier left, Brown right.)

I

K-3004 October 25, 1982. Hawaii. Maui, looking
toward Kahului Harbor. Standing on Mauna
series - a Humble Petropodonta fasciata.

K-3005 October 24, 1982. Hawaii. Maui, looking
toward Kahului Harbor site of K-3004 series.
(Tavernier left, Brown right.)



K-3006 October 25, 1962. Hawaii. Maui. Eroded Humic Ferrugineous Latosol. Note crust.



K-3007 October 25, 1962. Hawaii. Maui. Eroded Humic Ferrugineous Latosol with ironwood trees to control erosion.



X-3408

October 25, 1962. Hawaii. Maui. 5000 ft.
Hemic Ferrygineous latosol. No. 1000.

X-3407

October 25, 1962. Hawaii. Maui. 5000 ft.
Hemic Ferrygineous latosol with iron.
Press to control erosion.

OAHU

SCALE: ONE INCH EQUALS APPROX. 3 MILES
AREA 589 SQUARE MILES
PRINCIPAL ROADS: PAVED IMPROVED DIRT
SECONDARY ROADS
APPROXIMATE MILEAGES
STATE HIGHWAY MARKER (76)





Koko Head Section
Scale: Same as Main Map



The soil has a 10 percent slope and an elevation of about 375 feet. The rainfall is about 40 to 50 inches.

We go down the slope to a formerly eroded place where a hard crust has formed. (K-3006). Ironwood trees were planted to control the runoff and erosion. (K-3007). These plantings were quite successful but other sloping areas are still eroding.

We drive east to the other side of Kahului and look at sugarcane (K-3008) and koa haole - a tall forage crop used for pasture - on the Molokai soil. I am told that good pastures of this sort produce about 1,600 pounds of beef per acre annually.

We continue east for a long way and at sunset look at the Haiki series - another Humic Ferruginous Latosol. (It is now 5:40 p.m., or about midnight by the time I left home.) The soil is from andesite under about 80 to 90 inches of rainfall. In the lower part we see characteristic reticulate mottling and there seems to be a good deal of gibbsite. In the B horizon the red clay (10R 3.5/0) could be quite high in bauxite. The clay is firm but easily friable. Its lower boundary where the mottling begins comes at about 31 inches.

But it is too dark really to see the morphology and I fear that I am a bit too tired anyway. This soil would probably be a very good one for tea but with wage scales in Hawaii there is no way to harvest it economically. Since pineapples yield only fairly well the land is gradually

shifting to indifferent pasture.

We are back to the hotel about 5:45 p.m. I walk
off the red clay as best I can. After a late dinner
go immediately to bed.

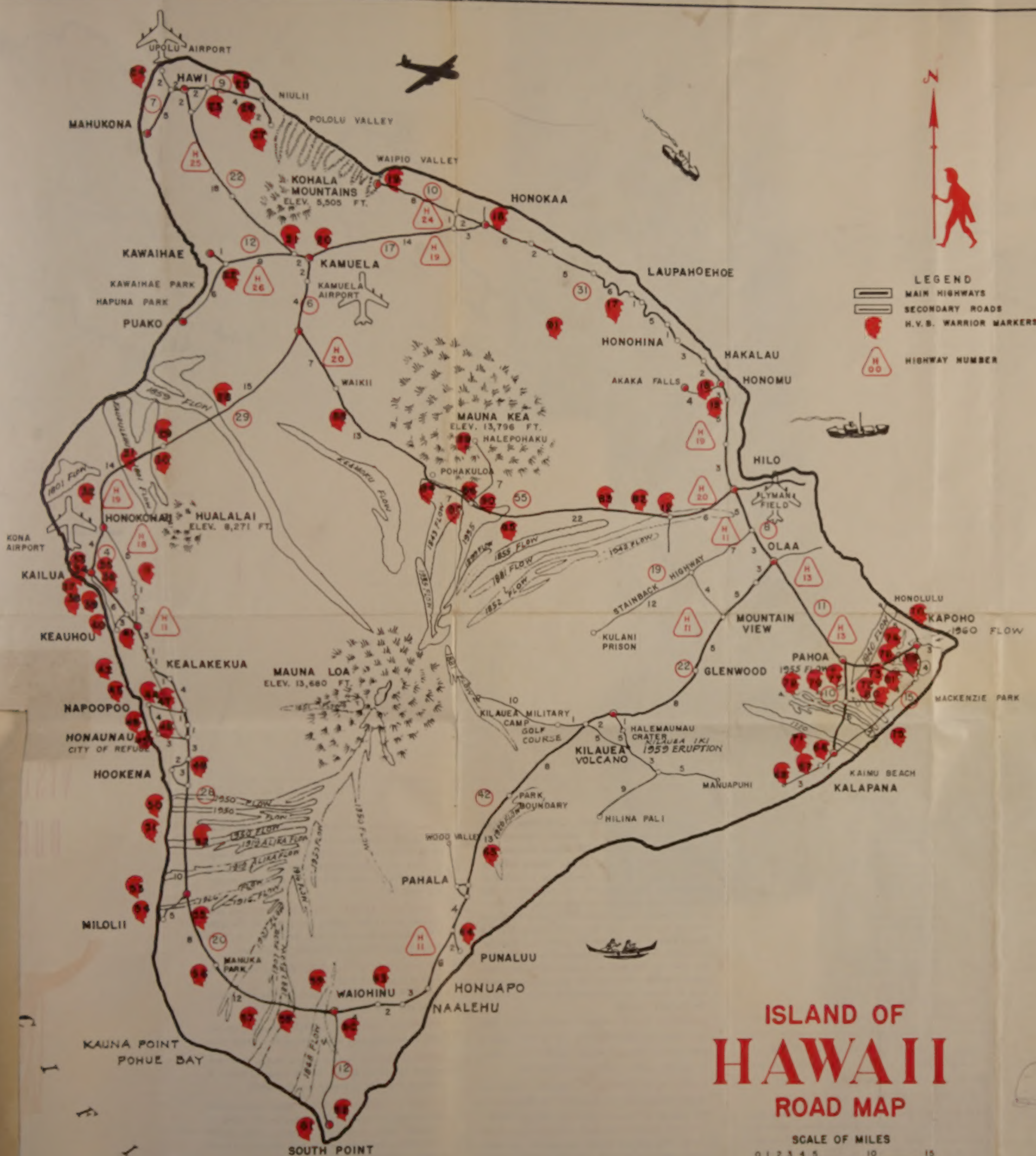


K-3008 October 25, 1962. Hawaii. Maui.
Sugarcane on Molokai soil (Brown).

K-3003 October 25, 1962. Hawaii. Maui.
Sugarcane on Molokai soil (Brown).

shifting to indifferent pasture.

We are back to the hotel about 6:45 p.m. I wash off the red clay as best I can. After a late dinner I go immediately to bed.



ISLAND OF HAWAII ROAD MAP

SCALE OF MILES
0 1 2 3 4 5 10 15

WARRIOR MARKERS		
NO.	NAME	NO.
15. Hono School	42. Kealahou Bay	67. Kalapana Park
16. Alaska Falls	43. Capt. Cook Monument	68. Queens Bath
17. Leupohokoe	44. Hikoia Heiau	69. Kapoho Cinder Cones
18. Honoahe Golf Club	45. City of Kailua	70. 1960 Flow, Kapoho
19. Waipio Valley	46. Kailua Baffle Field	71. 1790 Lava Flow
20. Iniole Church	47. Coffee Mill	72. 1840 Lava Flow
21. Kohala Mountains	48. Paired Church	73. Lava Trees
22. Puukohola Heiau	49. Coffee Trees	74. 1955 Flow, Kii Branch
23. Kamahameha Statue	50. 1955 Flow, Monohu Branch	75. 1955 Flow, March 19th
24. Moakini Heiau	51. 1955 Flow, Kailua Branch	76. 1955 Flow, Initial Outbreak
25. Kalahikiola Church	52. 1955 Flow, Kailua Branch	77. 1955 Flow, Kailua Branch
26. Kamahameha Rock	53. 1919 Flow	78. 1955 Flow, Kailua Branch
27. Palulu Valley	54. 1925 Flow	79. 1955 Flow, Kailua Branch
28. 1859 Lava Flow	55. Site of Old Catholic Church	80. 1955 Flow, Kailua Branch
29. Pounaewa	56. 1907 Flow, Kailua Branch	81. 1955 Flow, Kailua Branch
30. Maui Island	57. 1907 Flow, Kailua Branch	82. 1881 Lava Flow
31. Kaulahehe Lava Flow	58. 1881 Lava Flow	83. 1881 Lava Flow
32. 1881 Lava Flow	59. 1881 Lava Flow	84. 1843 Lava Flow
33. Early Fort	60. South Point	85. 1935 Lava Flow
34. Hulihee Palace	61. Ancient Canoe Landings	86. Mauna Kea
35. First Christian Church	62. Kailua Heiau	87. Mauna Loa
36. Old Catholic Church	63. Mark Twain Monkey Pod Tree	88. Hualalai
37. Kealahou Heiau	64. Birthplace of Henry Opukeia	89. Kailua
38. Judd Trail	65. Petroglyphs	90. Humuhumu Sheep Station
39. Kaulahehe Heiau	66. Kailua Beach, (Black Sand)	91. Kaulahehe—The Doctor's PH
40. Royal Slide		92. Chamber of Commerce
41. Kamahameha III Birthplace		

LEGEND
MAIN HIGHWAYS
SECONDARY ROADS
H.V.B. WARRIOR MARKERS
HIGHWAY NUMBER

YOUR TIPS
PUNA
1955 LAVA FLOW is 20-30 miles from Hilo on good road. Steam and considerable heat still exist after four years of surface inactivity.
BLACK SAND BEACH: Glistening natural beach of black sand. Near by is Kalapana village and Queen's Bath, a natural pool.
1960 KAPOHO ERUPTION: Wiped out the town of Kapoho. Huge cinder cone is still steaming.
LAVA TREES & MOLDS: State park devoted to stone "trees" left standing when molten lava receded and left coating on trees existing hundreds of years ago.
PAINTED CHURCH: This little Catholic Church, in Kalapana, has an interior that will surprise you. Painted years ago by the priests in charge, using ordinary house paints, it gives a multi-dimensional effect to the small interior. Catholics will find this of particular interest.
HAWAII NATIONAL PARK
VOLCANO MOVIES: Magnificent movies in full color are exhibited daily by park rangers at the national park headquarters across the Volcano House at 9:30, 1:15 and 4:45.
CHAIN OF CRATERS: Extinct volcanoes into which complete towns could rest. A beautiful drive, well marked and easy to follow.
KILAUEA (IKI): Erupted in 1959.
FERN FOREST: Huge tree ferns up to 40 feet high, massed in tropical ravines and along the fine driveway of the park. Beautiful photography.
LAVA TUBE: A natural tunnel formed by lava from its own flow. Visitors walk through the beautifully planned park trail in the tree fern forest.
BIRD PARK WALKS: By checking park schedules, nature hikes are enjoyed. Special arrangements can be made for visitors high on the slopes of Mauna Loa. Special Hawaiian National Park folder is available at Park Headquarters.
KAU
SOUTH POINT (Kalea): The southernmost point of land in the Hawaiian Islands is located in this district. Here may be seen ancient canoe moorings cut in the solid rocks and the remains of the Kalea Heiau. Recent findings by archaeologists indicate that one of the first Polynesians landed at this point and established residence as early as 700 B.C.
MARK TWAIN'S TREE: This tree was planted by Mark Twain, during an extended visit in the district of Waipahoehoe. This tree was blown down by the wind in 1957. The roots have sent up a new trunk, which is growing into a fine tree.
PUNALUU: Old sugar shipping port in open roadstead. Now noted for its black sand beach. Not as scenic by far as the Black Sand Beach of Kailua, still something to visit, particularly if you did not get down to Kalapana. About two miles down from the main road between Pahala and Kealahou. The sign says "Punaluu".
PETROGLYPHS: Interested in the unusual. See them unexplained "rock writings". Very similar to those found in the caves of the Southwest. You'll read someone who has been there before to show you these unusual rock pictures, even though only about a hundred yards from the road.
LAVA FIELDS: You need no guide to see these. Just stop anywhere along the road. All flows are noted with their dates and other information. Remember the smooth flowing lava that looks like congealed molten is called Pahoehoe. Pronounce it Pa-ho-e-ho. The rough crumbly type that looks like furnace sludge is called Aa. Pronounce it Ah-ah.
KONA
HOOPULOA FLOW: This flow destroyed a Catholic Church at the site of the marker. The flow continued on to the ocean wiping out the little Hawaiian King village of Hoopulua. There was NO loss of life.
CITY OF REFUGE AT HONAUNAU: Legendary sanctuary for the oppressed maintained by the great kahuna (priests) is now the National Historical Park. One of the truly beautiful spots of old Hawaii on the Kona coast.
NAPOOPOO: Captain Cook landed in Kealahou Bay. Truly a historic spot. Read the several monuments erected here to learn something of the coming of the white man to Hawaii. Across the bay you will see a white monument. This marks the spot where Captain Cook was killed. Here also is located the famous Hikoia Heiau.
CAPTAIN COOK COFFEE MILL: Napoosoo road. Try to go thru this mill. Here you will see how the famed Kona coffee gets its first start on the way to the breakfast table.
ROYAL SLIDE AT KEAUAHOU: Hawaiian version of the toboggan slide. Only for royalty and only for the tough ones at that. The ancient slid down this rock chute, rocks were covered with grass, on a wooden sled.
HULIHEE PALACE: Ancient summer home of Hawaiian royalty. This is preserved as a museum. You should go thru it, we think you'll find it interesting.
MOKUAIKAIKAU CHURCH: Reported to be the oldest church in Hawaii. A stark church reflecting the austere influence of the churches of the New England Missionaries, but lovingly fashioned years ago by the people of Hawaii from lava stone and the beautiful sea wood of the upland.
DEEP SEA FISHING: Kona's coast is one of the most famous fishing areas in the world because of the fine Marlin catches, smoother waters and year-round season. Boats are available at all times at Kailua Bay and may be arranged through your travel agent.
KAMUELA
PARKER RANCH: Most of the ranch country and site of the headquarters of famed Parker Ranch, second largest Herford cattle ranch in the United States. Many other ranches are located throughout this district which visitors will find reminiscent of the range country of the West. And those Hawaiian cowboys, yes, even with flower leis on their hats, are the match of any mainland cowpoke. Some have been World Champions.
HISTORIC CHURCH: In this same district one of the oldest churches, Iniole, may be seen.
KAWAIIHAE: About 17 miles from the highway at Kamuela is the all-weather sea port of Kawaihau with its adjacent beautiful sandy beaches and a large bulk sugar plant. The Puukohola Heiau, constructed by Kamahameha the Great, is also located here. Excellent for swimming and picnic place.
KOHALA
KAMAHAMEHA STATUE: The original statue of King Kamahameha is located in front of the Kohala courthouse. The statue in Honolulu is a copy.
POLOLU VALLEY LOOKOUT: An inspiring and rugged scenery. Other points of interest in Kohala are the Moakini Heiau, the Kalahikiola Church and the Kamahameha Rock.
HAMAKUA COAST
WAIPIO VALLEY: Drive to the end of the road at Kulahehe. One of the last remaining isolated Hawaiian communities. It's a rough trail down, used by mules, horseback, or jeep. Trips can be arranged at the Honoahe Hotel.
HONOHEHE MACADAMIA NUT FACTORY: Processing nuts and candy manufacturing. Guided tours, Monday through Thursday—7 A.M. to 11 A.M. and 12 Noon to 2 P.M. On Fridays—8:00 to 11:00 A.M.
LAUPAHOEHOE: One of the early boat landings along the sugar coast and years ago quite a community. Here over 20 students and teachers lost their lives in the tragic tidal wave of April 1, 1946.
AKAKA FALL: Located above the village of Honohehe, the road makes (up the hill) is marked by an HVB Hawaiian Warrior. A beautiful water fall in an unspoiled natural setting with a drop of over 400 feet. Excellent for picnicking.

A	Kanaloa Street	H23	
Aala Street	Q22	Kanaloa Street	O8
Aalupune Street	T28	Kapa Street	O18
Akaka Street	N21	Kapua Lane	S37
Aka Street	N1	Kapuli Avenue	S18
Akaka Avenue	117	Kapiolani Street	E19
Akalea Street	820	Kaheo Avenue	T19
Akuna Street	M21	Kaula Street	V34
Alapai Street	M22	Kaunana Drive	M13
Alahi Street	Q22	Kawili Street	E24
Alala Road	G5	Kawili Street	L38
Alakalea Road	P14	Kawa Street	T29
Alapa Street	N34	Kalihi Street	R35
Alaia Street	M4	Kahala Street	R25
Alao Street	R18	Kahala Street	T20
Alalahani Street	J11	Kahuna Street	Q24
Alala Lane	X19	Kahe Loop Road	P34
Alaia Road	F1	Kilauea Street	W71
Alaia Road	U17	Kilauea Street	T28
Andrew Avenue	U37	Kilauea Street	E4
Apapa Road	W37	Kilauea Lane	Q24
Apaki Street	O10	King Avenue	T36
Awapuhi Street	E28	Kinohi Street	F77
Ardu Lane	U20	Kona Street	N34
Awa St	A31	Kona Lane	Q24

Baker Avenue	T25	Kakea Street	N5
Banyan Drive	T29	Kala Road	C1
Barenaba Street	P23	Kamohana Road	F19
Beach Lane	T20	Kau Lane	U20
Bosmar Lane	R21	Kaula Street	N8
Buckley Lane	S21	Kerua Avenue	S36
Bishop Street	R24	Kuawa Street	R26
		Kuhia Street	U33

Cabrillo Lane	R23	Kukui Lane	Q24
Cheng St.	PV	Kunau Street	T31
Christina Lane	R23	Kumu Street	R22
		Kupulea Road	C14
		Kupukupu St.	O21

Derby Street	F23		
Dodge Avenue	U35	Lashala Street	W31
		Lahaina Street	O12

		Lahi Street	O6
Elisha Street	O18	Laimana Street	R18
Hepalea Street	S19	Lanikuli Street	O23
Emma or Waialae St.	R26	Lanikaule Street	W21
Euwalika Avenue	S37	Leale Road	A34
Euwalika Lane	U19	Kahaulani St.	F26

		Laudapo Avenue	O17
		Leakona Street	O12
Furness Street	521	Lehua Street	V19

Maikai Street	A36	Leilani Avenue	O21
Maiki Street	S20	Lele Street	N23
Malai Street	R17	Lihikai Street	S26
Malaulani Street	W19	Lihikai Road	W16
Male Street	R16	Lihailua Street	T27
Manakali Lane	R23	Liliuwa Street	J11
Mau Lane	X19	Lilikala Street	K21
Mai Lane	O20	Lono Street	N24
Malani Pl.	L12	Loula Lane	R20
Mama Street	O21	Luana Court	R23
Mina Street	O17	Luana Way	L12
Mimano Street	O27	Luka Street	T28
Moolimau Lane	R24	Lukani Street	J11
Moku Street	O23	Lyman Avenue	T31

Hamelani Lane	R20		
Manu Lane	Q25	De	
Huamama Road	Q16		H26
Hualalai Street	Q22	Haka Street	N25
Hualani Street	P27	Makaliu Street	A33
Hualalai Street	P15	Malani Road	P15
Maepale Lane	Q22	Makalani Road	Q3

Ulu Lane	U19	Mamano Street	T28
Umpolana or Serrao Lane	J10	Mama Street	S31
Ulu Street	U19	Manalo Lane	O19
Uma Lane	P19	Manini Street	O26
Uma Lane	O19	Manono Street	O26
Uluani Street	H25	Manuku Lane	L26
Uluani Street	O21	Mauna-Koa Street	O22
Ulu Lane	T19	Mauna-Loa Street	P22
Uluani Street	P13	Maynala Street	P12
Uluani or Uluani St.	O23	Maha Lane	N23
		Malani Street	H20
		Mallani Street	O26
		Maha Lane	R23

		Mokuola Street	M20
Josephine Lane	R23	Mokuola Street	S27
		Muliwai Lane	R26

K		N	
Chapman Street	G27	Nawau Street	J9
Kama Street	R16	Nalani Drive	A21
Kanai Street	U28	Naniakoa Street	D14
Kinohi Street	T27	Nawaki Lane	S22
Kulani Street	T18	Nihoa Street	N14
Kiwi Road	T10	Niailani Lane	R23
Kakua Street	T20	Nahoa Street	F25
Kamalu Lane	R23		
Kaniakole Ave.	U33		
Kanika Street	O28		
Kamakou Street	R19	Ocean View Drive	T30
Kamuna Street	X38	Ohai Street	U20
Kama Street	N24	Ohia Street	K27
Kamakaha Ave.	S22	Ohia Lane	H25
Kakoa Road	T27	Oia Street	O24
Koa Street	V20	Ollana Street	N11

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BALING

THE CHINESE VILLAGE

	1	2	3	4	5	
A						
B						
C						
D						
E						

Glenn Street	N26	
Olaf Street	G28	Santon Street
Omas Road	P15	Service Road
Onakabakha Road	W37	Shipman Street
Orange Lane	Q24	Silva Street
Osoorio Lane	R22	Spring Road
Operation Road	R29	

	P	T
Pala Street	C29	Todd Avenue
Palani Street	N11	
Panawea Street	Q22	Ualehue Street
Pauahi Street	Q23	Uhaloa Road
Peapea Falls Drive	P6	Uku Street
Pala Street	Q22	Uili Street
Piliaka Street	Q9	
Pilani Street	Q27	Uluho Road
Pilialoha Street	K12	Uluani Street
Piopia Street	Q24	Umuau Street
Pukahulani Street	G22	
Punahawai Street	Q19	
Puu Avenue	U35	Waianuenue Street

Pue Lane	W19	Waiku Street
Puinaku Street	I24	Walhee Lane
Puhale Lane	S27	Wallao Street
Pukihia Street	V20	Wallua Lane
Punahole Street	Q16	Walluku Drive
Punahoia Street	R24	Waimalio Lane
Punawai Street	Q16	Wainaku Street
Puuhi Lane	U19	Wailama Street
Puwao Street	U20	Waiwani Street
Puu Hine Street	Q14	Waipoua Lane
Puu Hanu Street	Q18	Wanana Lane
Pouko Street	K12	Wildor Road
	R	
Radio Road	R22	Williwil Street
Railroad Ave.	R29	Wilson Street

	NO.	NAME
H25	1.	Hawaii Visitors Bureau
Q29	2.	World War II Memorial
T20	3.	Rainbow Falls
T32	4.	Hawaiian Village, Waialae Riv
P16	5.	Boiling Pots
	6.	Mau's Canoe

7. Waikuku River
8. Hawaiian Village, Kneadshe
9. Coconut Island
10. Historical Stones
11. Keumena Caves
12. Hilo Country Club
13. Lyman Memorial Museum
14. Seismograph Station

TOUR TIPS

HILO AND VICINITY

KEAUKAHA HAWAIIAN VILLAGE
torchlight Hawaiian entertainment
days, Wednesdays and Thursdays, and
transportation to and from the

Q10 transportation to and from the V
U19 hotel desk. Programs are free.
O22
Y19 WAILOA RIVER PARK
T19 **LYMAN HOUSE MEMORIAL MUSEUM**
U19 Hawaiiana of this region. Visiting
W19 Thursday, Friday—10:00 A.M. to 12
R24 Wednesday—10:00 A.M. to 4:00
R22 and Sunday 1:00 to 4:00 P.M.
R22 **SUGAR PLANTATIONS:** Sugar p
U20 milling operations. Secure pass fro
F2 plantation offices.
P14 **LAUHALA WEAVING:** All types
Q23 articles from the leaves of Hale, or

can be obtained at Halemau
in the Panaewa Forest off
Orchid Isle Gift Shop at 219

NAHA STONE: Located at
was used by the ancient Hawaiians
determining the fitness of

GE: Authentic programs. Tues-
day 8:30 P.M. For

LILIUOKALANI PARK: A garden located on the shore of the suburb of Waiakae and

ORCHID NURSERIES AND DENS: Hilo is world famous for its orchids which can be seen at the University of Hawaii, Jewel Box Flower Show, Tanaka's Anthurium Nursery, Mauna Loa Orchids.

BULK SUGAR PLANT: Large plant in the State, this mill is located in the dock area.

the County Library, Hawaii as a method of the residents to the

one mile above Hilo, Hawaii. Try to visit it during the week. You will have the best chance

ANTHURIUM GAR. For orchids and anthurus local gardens: Orchids Shop, Hirose Nursery, Y. Kong's Floraleigh,

SUGAR PLANTATIONS: Sugar plantations and milling operations. Secure pass from any of the plantation offices.

LAUHALA WEAVING: All types of hand woven articles from the leaves of Hala, or Pandanus Trees

BULK SUGAR PLANT. Largest bulk sugar storage plant in the State, this multi-million installation is located in the dock area.

FISH MARKETS: At the Waialoa estuary visitors will enjoy the Fish Auction which begins at 7:30 A.M. daily except Sundays. Fish are auctioned off to various fish dealers. Sampans will be found along the Waialoa River, which are the backbone of Hawaii's Commercial fishing fleet.



CITY OF HILO
ISLAND OF HAWAII
ISSUED BY THE JUNIOR CHAMBER OF COMMERCE
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VISI
BUR

Hawaii!

October 26: I am up at 6:15. I find the ring in my brace is broken so I have a sewing job. We repack, have breakfast, and are ready for the airport at 8:00 a.m. Since Malmgren is late, Mel Williams drives several of us in and goes back for the others. They come in a few minutes and unhappily did not see Williams so he has the extra trip for nothing and makes it back just in time. We leave at 8:40 and arrive at Hilo at about 9:25 a.m. We have a beautiful view of the sea-coast of the Big Island northwest of Hilo.

Here we are met by Mr. Warren Ikeda, GS-11 party chief on the island of Hawaii. We go to the office in Hilo and hurriedly change into field clothes and drive out to the plantation village of Wainaku to look at the Hilo series ^{a/} - a Hydro Humic Latosol, rich in organic matter, allophane, and gibbsite. (Bill says this will become a Hydrandept in the Seventh Approximation.)

This is an unusual soil unknown to any of us elsewhere in the world. Recently part of this cane field was deeply plowed. The soil holds about 200 percent moisture. If a knife is pressed into the profile slowly it goes hard; and if pulled out slowly the soil sticks to it. But if the knife is thrust in

a/ Description attached.

rapidly and pulled out quickly, its surface is lubricated with water and little soil sticks. If one heavy vehicle goes over the soil it remains firm, but if others follow they sink into mud.

Material: Like other gels the soil has the property of thixotropy - under stress the water comes out. But then after awhile it recovers its gel state. Even within 24 hours after heavy rains one can drive heavy machines over it once.

Region: 330 The rainfall here is about 180 inches and the parent material is volcanic ash.

Unlike most other soils this one darkens as it dries.

Profile: The rainfall is fairly well distributed. Should it fail for a long period, the soil might turn to rock. If a clod is removed from beneath the surface and allowed to dry out, it shrinks very greatly and reaches the consistence of a lump of anthracite coal. The process is irreversible: the soil will not rewet when immersed in water.

I am promised a detailed description of this soil, together with some laboratory data.

We look hurriedly at the operation of the mechanical cane cutter and the machinery used for loading the cane on the trucks that take it to the mill. (K-3009; K-3010; K-3011).

HILO SERIES
(S58Hal-1-1 through 14)

Location: Approximately 1.8 miles north of Hilo Post Office. Sample site is located 100 feet south of road at a point 0.3 mile west of Haaheo School which is at the north end of Wainaku Village. Island of Hawaii.

Classification: Hydrol Humic Latosol.

Parent Material: Volcanic ash.

Climate: 175 inches of rainfall.

Vegetation: Originally ohia-tree fern vegetation, now cleared and in sugar cane.

Physiography: Undulating to rolling low windward slopes of Mauna Kea. Three per cent slope to east.

Elevation: 350 feet.

Drainage: Well drained. Profile always moist as it rains nearly every day.

Remarks: The B horizon dries irreversibly and to a darker color. The A horizon shows no tendency to dry irreversibly. Stratification or layering of the profile is due to ash falls.

Soil Profile: Hilo silty clay loam^{1/}

A _{1p}	0-16"	Dark-brown (9YR 3/3), mixed with dark reddish brown (5YR 3/4) by cultivation, silty clay loam; weak medium subangular blocky structure breaking to weak very fine and fine granular structure; friable when moist, sticky and plastic when wet, moderately smeary; many roots; many very fine and fine interstitial pores; few to common firm ash nodules; abrupt smooth lower boundary. 15 to 18 inches thick.
S58Hal-1-1		
B ₂₁	16-21"	Dark reddish-brown (5YR 3/3), with stringy coating on ped surfaces of reddish brown (5YR 4/4), silty clay loam; weak medium subangular blocky structure with pockets, moderate very fine subangular blocky structure; friable when moist, sticky and plastic when wet, smeary; many roots; many very fine and fine and common medium and few coarse tubular pores; thick gelatinous coating on ped surfaces, some surfaces appear like clay flow; few firm ash nodules, nodules smeary; abrupt smooth boundary. 3 to 6 inches thick.
S58Hal-1-2		

^{1/} Although most of the soil material in the profile is probably finer than 2 microns, the textures given are the ones determined by "feel" in the field.

FIELD NOTES (25881-1-1 through 1-4)

Location: Approximately 1.8 miles north of Highway 200, 200 feet south of road at a point 0.5 mile west of school which is at the north end of Johnson Village, Johnson County, N.M.

Classification: Volcaniclastic tuff.

Parent Material: Volcanic ash.

Climate: 175 inches of rainfall.

Vegetation: Originally this area bore vegetation, now mostly in brushy areas.

Physiography: Undulating to rolling low windward slopes of Mount Hood. Three per cent slope to east.

Elevation: 350 feet.

Drainage: Well drained. Profile always moist as it rains nearly every day.

Remarks: The horizon does not necessarily end to a darker color. The horizon shows no tendency to dry irreversibly. Stratification or layering of the profile is due to ash falls.

Soil Profile: This is a clay loam.

0-10" 25881-1-1 Dark brown (2YR 3/3) mixed with dark reddish brown (2YR 3/4) by oxidation, silty, loam; weak medium subangular blocky structure; brown to weak fine and fine granular structure; friable when moist, sticky and plastic when wet, moderately earthy; many roots; many very fine and fine interstitial pores; few to common fine ash nodules; sharp smooth lower boundary. 13 to 15 inches thick.

10-21" 25881-1-2 Dark reddish-brown (2YR 3/3) with stringy coating on bed surfaces of reddish brown (2YR 4/4), silty clay loam; weak medium subangular blocky structure with pockets, moderate very fine subangular blocky structure; friable when moist, sticky and plastic when wet, earthy; many roots; many very fine and fine and common medium and fine coarse tubular pores; thick platy coating on bed surfaces, some surfaces appear like clay flow; few fine ash nodules, nodules earthy; sharp smooth boundary. 3 to 6 inches thick.

IV Although most of the soil material in the profile is probably finer than 2 micron, the textures given are the ones determined by feel in the field.

2 - Hilo Series (S58Hal-1-1 through 14)

- B₂₂ 21-23" Dark reddish-brown (2.5YR 3/4), with stringy reddish-brown (5YR 4/4) coating on ped surfaces, silty clay loam; S58Hal-1-3 weak fine and very fine subangular blocky structure with pockets of moderate very fine subangular blocky structure; friable when moist, sticky and plastic when wet, smeary; common roots; many very fine and fine and common medium and few coarse tubular pores; common firm ash nodules of 1/2 to 1 inch in diameter; ped surfaces have gelatinous appearance; abrupt smooth boundary. 1 to 2 inches thick.
- B₂₃ 23-26" Dark-brown (7.5YR 3/2) with stringy dark-brown (5YR 4/4) coating on ped surfaces and small pockets of dark reddish brown (2.5YR 3/3), silty clay loam; weak fine and medium S58Hal-1-4 prismatic breaking to moderate very fine subangular blocky structure; friable when moist, sticky and plastic when wet, smeary; common fine roots; many very fine, fine and medium and few coarse tubular pores; ped surfaces have gelatinous appearance, some surfaces look like clay flows; few firm ash nodules; abrupt smooth boundary. 2 to 5 inches thick.
- B₂₄ 26-30" Dark reddish-brown (5YR 3/4), with stringy reddish-brown (5YR 4/4) coating on ped surfaces and small pockets of S58Hal-1-5 dark reddish brown (2.5YR 3/4) and dark brown (10YR 3/3), silty clay loam; weak fine and medium prismatic breaking to moderate very fine subangular blocky structure; friable when moist, sticky and plastic when wet, smeary; common fine roots; many very fine, fine and medium and few coarse tubular pores; ped surfaces have translucent gelatinous appearance, some coatings appear like clay flows; few firm ash nodules; abrupt smooth boundary. 4 to 6 inches thick.
- B₂₅ 30-32" Dark reddish-brown (2.5YR 3/4), with stringy reddish-brown (5YR 4/4) coating on ped surfaces and small pockets of S58Hal-1-6 dark brown (7.5YR 3/2), silty clay loam; structure is weak medium subangular breaking to moderate subangular blocky; friable when moist with many fine firm nodules; sticky and plastic when wet, smeary; few fine roots; many very fine, fine and common medium and few coarse tubular pores; ped surfaces have translucent gelatinous appearance; abrupt smooth boundary. 1/2 to 3 inches thick.
- B₂₆ 32-33" Dark-brown (7.5YR 3/2), with thick stringy reddish-brown (5YR 4/4) coating on ped surfaces and small pockets of S58Hal-1-7 5YR 3/4, silty clay loam; moderate very fine subangular blocky structure; friable when moist, sticky and plastic when wet, smeary; few fine roots; many very fine, fine and common medium and few coarse tubular pores; thick translucent gelatinous coating on ped surfaces that appear like clay flows; few firm ash nodules; abrupt smooth boundary. 1/2 to 2 inches thick.

3 - Hilo Series (S58Hal-1-1 through 14)

- B27 33-37" Dark reddish-brown (5YR 3/4), with stringy reddish-brown (5YR 4/4) coating on ped surfaces, silty clay loam; structure is weak fine and medium prismatic breaking to moderate very fine subangular blocky structure; friable when moist, sticky and plastic when wet, smeary; few roots; many very fine, fine and medium and few coarse tubular pores; thick gelatinous coating on ped surfaces; few firm ash nodules of dark reddish brown (2.5YR 3/4); clear smooth boundary. 3 to 5 inches thick.
S58Hal-1-8
- B28 37-49" Dark reddish-brown (5YR 3/4), with stringy reddish-brown (5YR 4/4) coating on ped surfaces and small pockets of dark brown (7.5YR 3/2), silty clay loam; structure is weak fine and medium prismatic breaking to moderate fine and medium subangular blocky with numerous pockets of strong very fine subangular blocky; friable when moist except peds of strong structure which are firm, sticky and plastic when wet, smeary; few roots; many very fine, fine and medium and few coarse tubular pores; few firm ash nodules of dark reddish brown (2.5YR 3/4); thick gelatinous coating on ped surfaces, some of which appear as very thick clay flows; clear smooth boundary. 8 to 14 inches thick.
S58Hal-1-9
- B29(?) 49-51" Dark-brown (7.5YR 3/3), with thin stringy reddish-brown (5YR 4/4) coating on ped surfaces and small pockets of dark reddish brown (2.5YR 3/4), silty clay loam; structure is weak medium prismatic breaking to strong very fine subangular blocky; friable when moist, sticky and plastic when wet, moderately smeary; no roots; many very fine, fine and common medium tubular pores; thick translucent gelatinous coating on ped surfaces; few firm ash nodules; abrupt smooth boundary. 1 to 2 inches thick.
S58Hal-1-10
- B210 51-53" Dark reddish-brown (2.5YR 3/4), with thin stringy reddish-brown (5YR 4/4) coating on ped surfaces, silty clay loam; structure is weak medium prismatic breaking to weak very fine and fine subangular blocky with pockets of moderate very fine subangular blocky structure; friable when moist, sticky and plastic when wet, smeary; no roots; many very fine, fine and medium and few coarse tubular pores; thick gelatinous coating on ped surfaces; common firm ash nodules of 1/4 to 3/4 inch in diameter; abrupt smooth boundary. 1 to 3 inches thick.
S58Hal-1-11
- B211 53-56" Dark reddish-brown (5YR 3/4), with many fine stringy reddish-brown (5YR 4/4) coatings on ped surfaces, silty clay loam; structure is weak medium prismatic breaking to moderate very fine subangular blocky, few pockets of strong very fine subangular blocky structure; firm when moist, sticky and plastic when wet, smeary; no roots; many very fine, fine and medium and few coarse tubular pores; translucent gelatinous coating on ped surfaces; few firm ash nodules; abrupt smooth boundary. 2 to 3 inches thick.
S58Hal-1-12

4 - Hilo Series (S58Hal-1-1 through 14)

- B212 56-58" Dark reddish-brown (2.5YR 3/4), with many fine stringy reddish-brown (5YR 4/4) coatings on ped surfaces, silty clay loam; structure is weak medium prismatic breaking to moderate very fine subangular blocky; friable when moist, sticky and plastic when wet, smeary; no roots; many very fine, fine and common medium and few coarse tubular pores; ped surfaces have translucent gelatinous appearance; many firm ash nodules of 1/4 to 1 inch in diameter; abrupt smooth boundary. 1/2 to 2 inches thick.
- S58Hal-1-13
- B213 58-67"+ Dark reddish-brown (5YR 3/4), with many fine stringy reddish-brown (5YR 4/4) coatings on ped surfaces, silty clay loam; structure is weak medium prismatic breaking to strong very fine subangular blocky; friable when moist, sticky and plastic when wet, smeary; no roots; many very fine, fine and common medium and few coarse tubular pores; ped surfaces have gelatinous appearance; few firm ash nodules.
- S58Hal-1-14

SOIL SURVEY LABORATORY
Beltsville, Md.

Location Hawaii Island, Hawaii
Lab Nos. 59495 - 59501

Soil Type Hilo Silty Clay Loam
Survey Nos. S58 HA 1-1-(1-7)

Laboratory Number	Depth Inches	Horizon	PARTICLE SIZE DISTRIBUTION (in mm.) (per cent)										Textural Class		
			Very Coarse Sand 2-1	Coarse Sand 1-0.5	Medium Sand 0.5-0.25	Fine Sand 0.25-0.10	Very Fine Sand 0.10-0.05	Silt 0.05-0.002	Clay 0.002-0.001	International		> 2			
										II 0.2-0.02	III 0.02-0.002				
59495	0-16	A _{1p}													
59496	16-21	B ₂₁													
59497	21-23	B ₂₂													
59498	23-26	B ₂₃	}	NOT DETERMINED - SAMPLES FLOCCULATED BY											
59499	26-30	B ₂₄		SODIUM HEXAMETA PHOSPHATE TREATMENT											
59500	30-32	B ₂₅													
59501	32-33	B ₂₆													
			pH		ORGANIC MATTER			Free Iron Oxide %	C.E.C. by K SATURA.	Field Moisture %	Bulk Density	MOISTURE RETAINED AT			
			H ₂ O	Kcl	Difference	Organic Carbon %	Nitrogen %					C/N	1/10 Atmos. %	1/3 Atmos. %	15 Atmos. %
			1:1	1:1	H ₂ O-Kcl										
59495	5.8	5.6	+0.2	5.30	0.408	13	22.0	46.2	126	0.33		110.6	69.8		
59496	6.1	6.2	+0.1	3.06	0.223	14	23.2		209			156.8	105.6		
59497	6.4	6.5	+0.1	2.00	0.129	16	26.9		152			104.7	99.8		
59498	6.3	6.4	+0.1	3.23	0.219	15	22.8		236			215.6	123.1		
59499	6.2	6.3	+0.1	3.08	0.220	14	25.0		229			202.8	124.9		
59500	6.4	6.5	+0.1	2.26	0.160	14	26.0	52.4	203			179.2	105.5		
59501	6.4	6.4	0.0	2.28	0.159	14	23.6		187			168.0	99.2		
	Cation Exchange Capacity (Sum)	EXTRACTABLE CATIONS					Base Saturation % (Sum)	Surface Area		CLAY MINERALOGY					
		Ca	Mg	Na	K	M		%	M ² /g	K	G	AM	Q		
		← Milliequivalents per 100g soil →						Glycerol							
59495	67.6	2.0	1.8	0.07	0.14	63.6	6	9.45	180	-	30	xxxx	x		
59496	68.4	2.2	0.6	0.04	0.06	65.5	4	11.13	212						
59497	54.2	1.8	0.3	0.02	0.02	52.1	4	11.32	216						
59498	66.6	2.4	0.3	0.07	0.03	63.8	4	11.05	211						
59499	66.7	1.3	1.0	0.03	0.03	64.4	4	10.90	208	-	30	xxxx	x		
59500	59.2	1.2	0.3	0.03	0.03	57.6	3	10.22	195						
59501	57.0	1.4	0.3	0.03	0.03	55.2	3	11.50	220						

SOIL SURVEY LABORATORY
Beltsville, Md.

Location Hawaii Island, Hawaii
Lab Nos. 59502 - 59508

Soil Type Hilo Silty Clay Loam
Survey Nos. S58 HA 1-1-(8-14)

Laboratory Number	Depth Inches	Horizon	PARTICLE SIZE DISTRIBUTION (in mm.) (per cent)										Textural Class		
			Very Coarse Sand 2-1	Coarse Sand 1-0.5	Medium Sand 0.5-0.25	Fine Sand 0.25-0.10	Very Fine Sand 0.10-0.05	Silt 0.05-0.002	Clay <0.002	International		>2			
										II 0.2-0.02	III 0.02-0.002				
59502	33-37	B27													
59503	37-49	B28													
59504	(?)49-51		DID NOT RUN - SAMPLE FLOCCULATED												
59505	51-53														
59506	53-56														
59507	56-58														
59508	58-67+														
			pH			ORGANIC MATTER			Free Iron Oxide %	C.E.C. by K SATURA.	Field Moisture %	Bulk Density	MOISTURE RETAINED AT		
	H ₂ O 1:1	Kcl 1:1	Difference H ₂ O-Kcl	Organic Carbon %	Nitrogen %	C/N	1/10 Atmos. %	1/3 Atmos. %					15 Atmos. %		
59502	6.3	6.4	+0.1	2.90	0.213	14	24.4		254			230.6	129.1		
59503	6.3	6.3	0.0	3.23	0.227	14	25.3		302	0.54		283.3	149.5		
59504	6.4	6.4	0.0	3.12	0.177	18	19.7		240			238.6	132.6		
59505	6.4	6.5	+0.1	1.87	0.116	16	25.4		202			180.3	153.1		
59506	6.3	6.4	+0.1	2.72	0.190	14	27.2		273			256.4	206.2		
59507	6.3	6.5	+0.2	2.28	0.136	17	26.6		225			212.7	175.9		
59508	6.4	6.4	0.0	2.21	0.160	14	24.8	74.8	254			238.9	196.6		
	Cation Exchange Capacity (Sum)	EXTRACTABLE CATIONS					Base Saturation % (Sum)	Surface Area		CLAY MINERALOGY					
		Ca	Mg	Na	K	M		% Glycerol	M ² /g	K	G	AM	Q		
		← Milliequivalents per 100g soil →													
59502	57.1	1.8	0.4	0.04	0.07	54.8	4	11.19	214						
59503	67.6	2.4	0.4	0.04	0.04	64.7	4	13.18	252						
59504	77.7	1.7	1.0	0.03	0.03	75.0	4	11.01	210						
59505	57.2	1.2	0.3	0.03	0.03	55.6	3	8.86	169						
59506	61.7	2.6	0.4	0.07	0.04	58.6	5	11.62	222	-	20	XXXX	X		
59507	69.6	2.6	0.3	0.03	0.03	66.6	4	9.71	185						
59508	72.4	2.5	0.7	0.04	0.04	69.1	4	9.81	187						



K-3009 October 26, 1962. Hawaii. At Wainaku,
near Hilo. Cane cutter.



K-3010 October 26, 1962. Hawaii. At Wainaku,
near Hilo. Cane cutter in action.

K-3009 October 26, 1982. Hawaii. At Waianae
near Hilo. Cane cutter.

K-3010 October 26, 1982. Hawaii. At Waianae
near Hilo. Cane cutter in accident.



K-3011 October 26, 1962. Hawaii. At Wainaku,
near Hilo. Crane for loading sugarcane.

K-3011 October 26, 1963. Hawaii. At Waipahoehoe,
near Hilo. Crane for loading sugarcane.

After lunch we drive generally south of Hilo and look at the Halemaumau Crater and also drive up to the Kilauea Crater.

Under high rainfall we see some interesting vegetation on undulating pahoehoe lava. This young lava has weathered but little. Yet the rainfall is high and an organic mat covers it. The vegetation is an interesting mixture of broomsedge and wild orchids. There is fairly pronounced micro-relief that helps catch the water, which escapes by drainage through the cracks.

We stop at a new eruption - the Kapoho eruption of 1961. This destroyed a small village and produced a beautiful cone of ash with recent gullies. Toward the sea from the village of Kapoho we see some very interesting agriculture on recently deposited aa lava on smooth relief. The surface is crushed with heavy rollers and smoothed with bulldozers. Holes are made for shrubs or trees, which are planted with a little soil from the outside. The surface is mulched. I see an excellent planting of papaya and (K-3012) of the "lipstick" plant (K-3013), used in making flower arrangements. We see a planting of Acerola bushes. The berries are very high in extractable ascorbic acid. There is a factory nearby for manufacturing vitamin C.



K-3012 October 26, 1962. Hawaii. Kapoho. Papaya on cracked (aa) lava. (Ikeda).



K-3013 October 26, 1962. Hawaii. Kapoho. Lipstick plant on cracked lava. Plants used in flower arrangements. (Ikeda).

K-3913 October 26, 1962. Hawaii. Kapoho. Pappas on cracked (aa) lava. (Ikeda).

K-3913 October 26, 1962. Hawaii. Kapoho. Pappas on plant on cracked lava. Plants used in flower arrangements. (Ikeda).

All of this intensive horticulture is on "Class VIII" land. I will now have photographic evidence for my insistence on qualifications of the definition of Class VIII land - that it returns no on-site benefits for plant use without drastic reclamation.

We leave for the office a little late and get there at 5:15 p.m. so I have to hurry to get my clothing rearranged and packed. Then we are taken to the airport and check in with considerable confusion. (Probably once the boys got me in when they promised, but this is so long ago that I don't remember it.) We get a bit of supper in a hurry and leave about 6:30 p.m. The plane makes an unscheduled stop at one of the other islands so we arrive in Honolulu at 8:10 p.m. I am in my hotel room at the Reef Tower about 8:30. This has been a very interesting day. Ikeda seems to be a good soil scientist.

We look at the Molokai series - a low humic latosol (K-3014). There is about 5 percent organic matter in the surface with a few clayey lenses. It is rather loose in a compact horizon, but the soil is friable when removed. Originally it was thought that this soil was residual from basalt. Probably it was developed from an lava with some clasts, ash, and local alluvium above it.

October 27: This is a warm morning. After breakfast I sort out my clothes and we all move everything into Johnson's room because we'll be here after check out time. Then we go out in the field east of Honolulu. Mr. Elmer Lloyd Hill is with us. He is in charge of the soil survey on Oahu.

Mr. Williams explains that on the Wahiawa Plain there are a whole series of surfaces giving three different families of soils. The geomorphology is not all worked out. Probably the surfaces are old and of different ages. But they may have been formed from somewhat different lava or have different coverings of ash or alluvium.

These soils have 15 to 25 percent free iron at the first leaching, yet it is necessary to use ferrous sulphate fertilizer every two weeks on the pineapples. I am continually amazed at the enormous increase in the number of pineapple plants per acre compared to 1936. They now have about 15,000 per acre and it is nearly impossible to walk through a mature stand.

We look at the Molokai series - a Low Humic Latosol (K-3014). There is about 5 percent organic matter in the surface with a few clayskins beneath. At 25 inches there is a compact horizon, but the soil is friable when removed. Originally it was thought that this soil was residual from basalt. Probably it was developed from aa lava with some cinders, ash, and local alluvium above it.



K-3014 October 27, 1962. Hawaii. Near Honolulu.
Roadside profile of Molokai series - Low
Humic Latosol.



October 27, 1962. Near Honolulu
L to R. Hill, ----, Mel Williams, Tavernier,
CEK, Brown, (photo by W. M. Johnson).

III

K-3032 October 27, 1962. Hawaii. Near Honolulu.
Roadside profile of Molokai series - low
Huntic latosol.

October 27, 1962. Near Honolulu.
I to R. Hill, ---, Mel Williams, Taverham.
GEX, brown, (photo by W. W. Johnson).

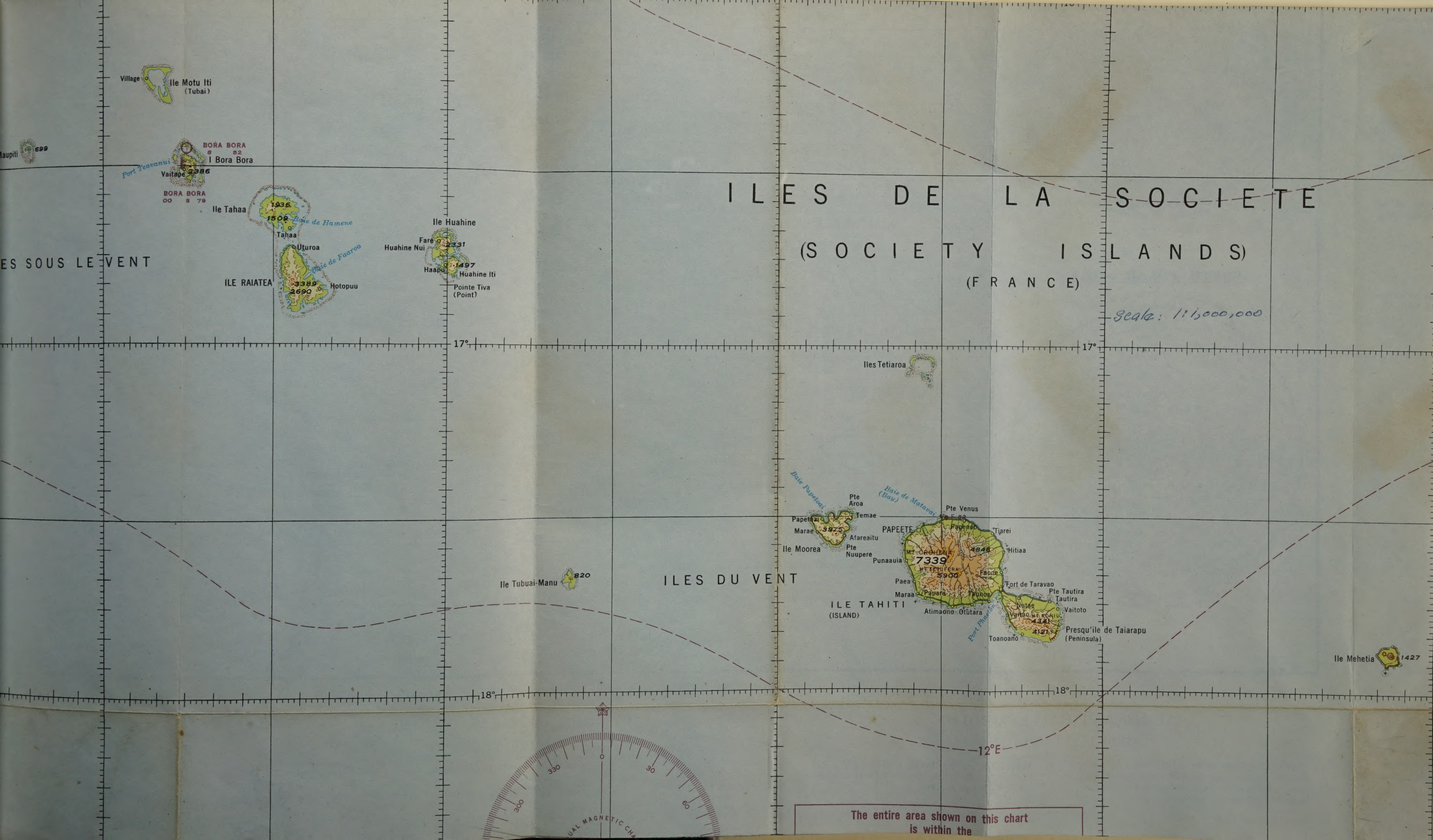
We drive up the field road. Workmen are chopping the old pineapple plants, burning them, plowing, and discing.

We look briefly at the Kole Kole series - a Humic Ferruginous Latosol. One sees a sharp contrast between the surface and the lower soil, which may represent the hardened B of a former Hydro Humic Latosol that has dried irreversibly and fragmented. The soil above it is high in allophane, likely from ash. The surface soil may be from reworked colluvium from higher land.

I am impressed how much Johnson, Cady, Ruhe, and the others are expanding our appreciation of the geomorphological complexities. The soils seemed simpler in 1936 than they do now! If our understanding increases further they may seem simpler than they do now.

We have lunch in the suburbs and drive back to the hotel, bathe, pack, and rest a bit. We leave the hotel at 3:55 and check in for our flight to Papeete. We are slow in getting started and finally leave Honolulu at 6:40 - 20 minutes late. Some native Tahitians sing and play on the plane so the time passes fairly well and the trip is smooth.

We are down in Papeete at 11:15. It takes quite a time to get through customs and get our baggage. We arrive at the Matavai Hotel about 1:10 a.m. In about 20 minutes I am shown to my cabin and go to bed. But I hear music and dancing - so this is a two-sleeping-tablet bedroom.



ILES DE LA SOCIETE

(SOCIETY ISLANDS)

(FRANCE)

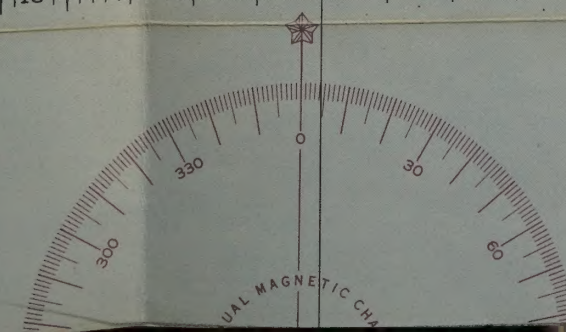
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ILES DU VENT

ILE TAHITI
(ISLAND)

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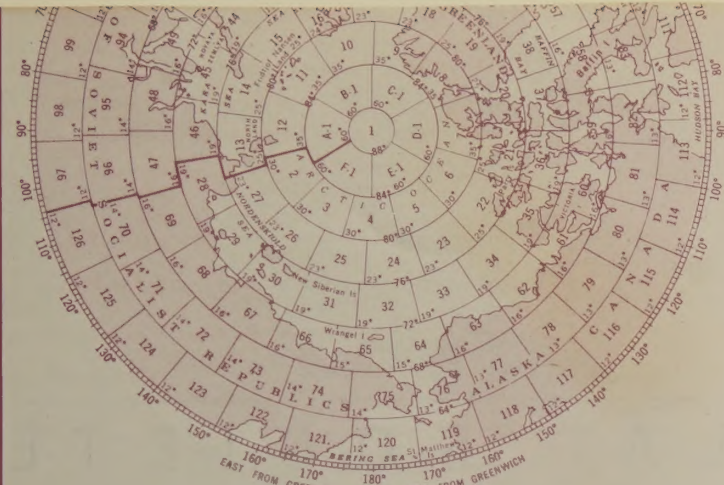
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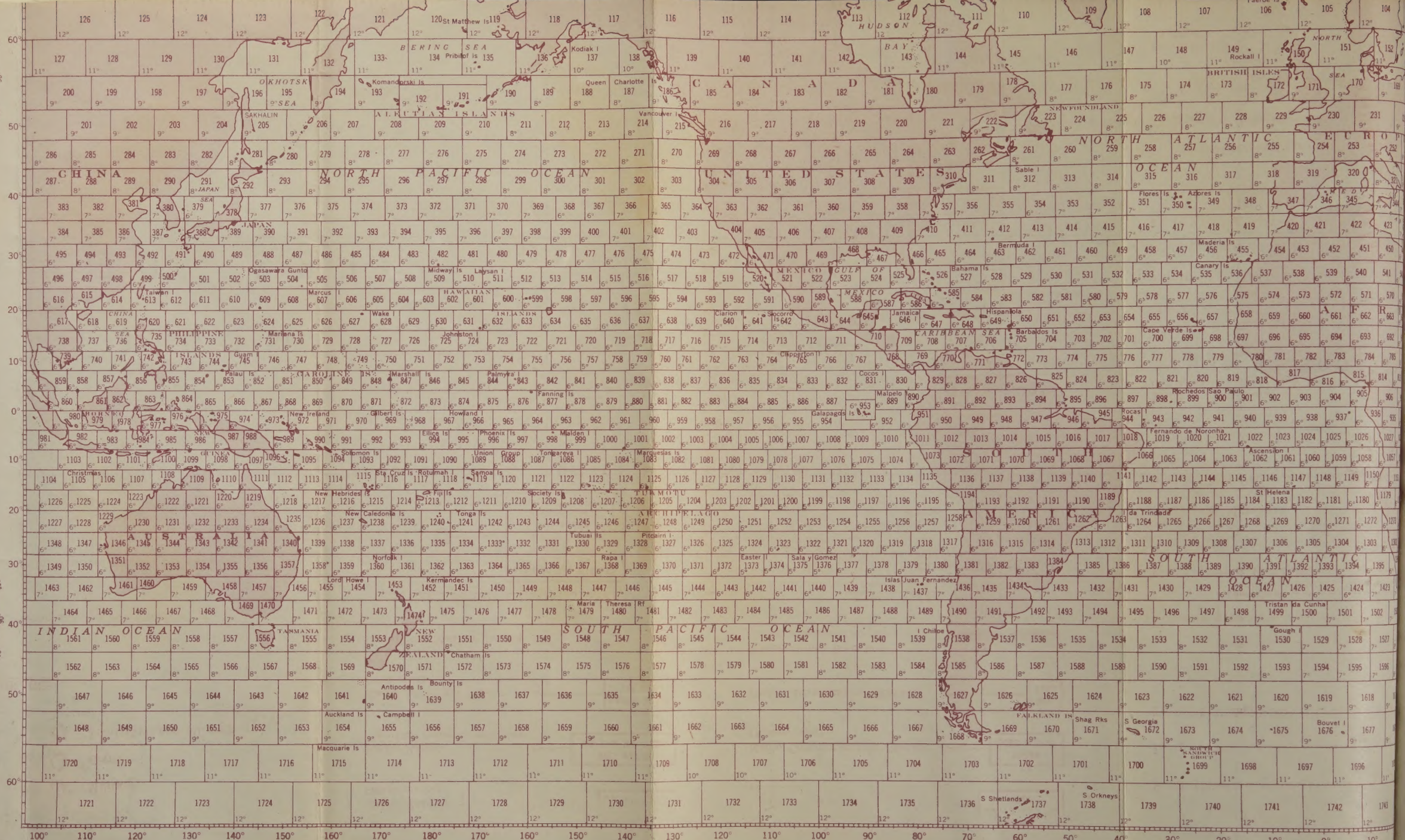
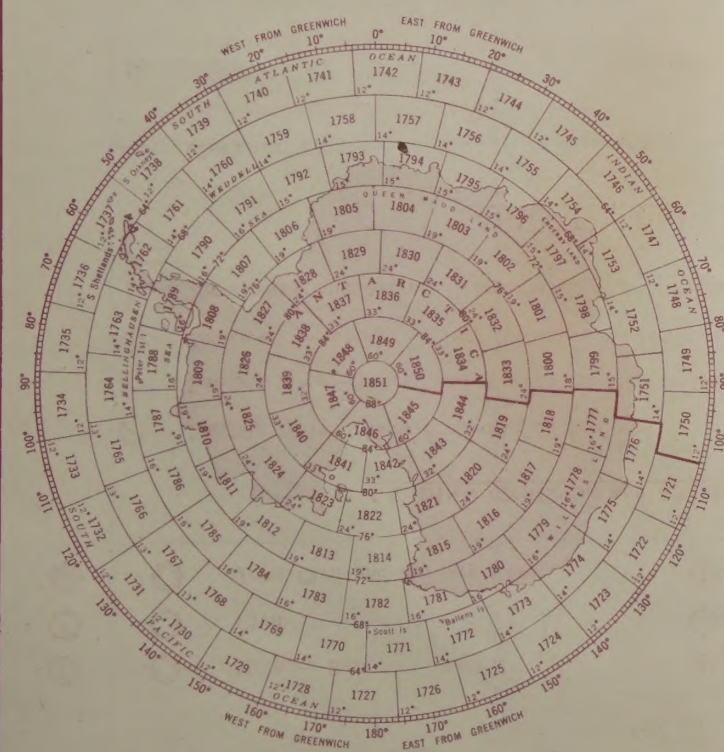
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SOUTH POLAR AREA



WORLD AERONAUTICAL CHART INDEX

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AERONAUTICAL SYMBOLS

AIRCRAFT FACILITIES

AIRPORTS—COMPLETE FACILITIES Refueling services, complete repairs, shelter, and (where applicable) passenger or cargo services and/or seaplane ramp with hauling-out facilities.

SEAPLANE LANDPLANE

AIRFIELDS or SEAPLANE PORTS—LIMITED FACILITIES Refueling services for normal traffic and limited repair facilities.

SEAPLANE LANDPLANE

AERONAUTICAL SYMBOLS

RADIO FACILITIES

All frequencies are kilocycles unless otherwise stated. Use of the word **RADIO**, **AIRWAYS**, **CONTROL** or **HOMER** within the box indicates "Voice facilities". **RBN** preceded by the letter **M** indicates a Marine Beacon.

Radio Range
(With voice)



WOODY RADIO
291 AB

Non-Directional Radio Beacon
(Without voice)



RBN
EVERETT
224 MMC

Radio Range



WILLOW RANGE
320 KB

Radio Communication Station



CS
GOWEN AIRWAYS
4220

CITIES and TOWNS

Metropolitan Areas ----- NEW

Large Cities ----- RIC

Cities -----



Ph. Mackenzie

Port de Papeete

Si vous êtes sportifs

- Remontez la vallée de la Fataua jusqu'au pied de la cascade rendue célèbre par le poète-romancier Pierre LOTI.
- A partir de la station de Fare Rau Ape vous pourrez entreprendre l'ascension facile du sommet de l'Aorai (2 jours). Refuge à 2.000 mètres.
- Remontez la vallée de la Pape-noo en pêchant des Nato à la mouche.
- Pourquoi ne prendriez-vous pas un guide pour aller reconnaître le lac Vaihiria?
- Partez en pirogue explorer les fonds sous-marins et les bancs de coraux du lagon sans oublier votre masque.
- Club hippique, Club Nautique, Club Alpin, Tennis, etc...

Vous louerez facilement une voiture, un scooter, un vélomoteur, soit pour aller vous baigner dans le lagon, soit pour faire votre tour de l'île.

Et voici maintenant le bungalow polynésien que vous pourriez louer.

Partez par la côte Est et ne manquez pas :

- a Km 4 : Tombeau de Pomaré V.
- b Km 8 : Belvédère de Taharaa - Point de vue panoramique.
- c Km 10 : Pointe Vénus - Monument de Cook. Bain sur la plage de sable noir.
- d Km 18 : Vallée de Papenoo - La plus grande de l'île - Bain de rivières.
- e Km 32 : Rivière de Faarahi - Radier de Mahaena - Bain.
- f Km 45 : Site et cascade de Faatautia.
- g Km 47 : Estuaire de la Papeiha - Plage.
- h Km 60 : Taravao - Déjeuner dans l'isthme.
- i Km 78 : Avant de traverser l'isthme, faites un crochet par Tautira 18 km, point de départ des excursions en pirogue à moteur vers le site du Pari.

Votre tour de l'île
(120 km)



Le groupe Heiva surpris au cours d'un tour de l'île.

Visitez les archipels

Le souvenir des baies de Moorea, du lagon de Bora-Bora et des camps de pêche des Tuamotu vous marquera.

C'est aux Iles-sous-le-Vent (Huahine, Raiatea, Bora-Bora) que vous ferez de la pirogue à voile ; c'est à Rangiroa ou Takaroa, ces îles où le canot à moteur remplace l'automobile et le camion, que vous ferez des parties de pêche miraculeuses.

Moorea

A Moorea, la sauvage, l'une des plus belles îles de tout le Pacifique, vous devez aller visiter les baies de Cook et d'Opunohu, elles sont mondialement célèbres. En pirogue vous pouvez aller soit vous baigner dans les eaux d'émeraude du lagon de Temae, soit poursuivre jusqu'aux îlots Tiahura.

Ph. Sylvain



Baie de Cook Moorea.

Papeete

La Capitale de la POLYNÉSIE FRANÇAISE avec ses airs de sous-préfecture, compte 16.000 habitants, 17 médecins, 8 dentistes, 4 Agences de Voyages, un Rotary Club, un Lions Club, des églises Catholiques, Protestantes, Adventistes, Mormones et Sanito. Vous pourrez y acheter vins, alcools et parfums de Paris aussi bien que curios de fabrication locale : costume de danse (more), bois sculptés, colliers de coquillages, etc...

Garde-robe :

Monsieur circulera en sandales, pantalon ou short clair et chemise tahitienne — Madame se devra de porter une robe pareo et des nu-pieds japonais. Chacun portera un chapeau de paille orné de fleurs ou de coquillages.

Achats au marché de Papeete.



Ph. Sylvain



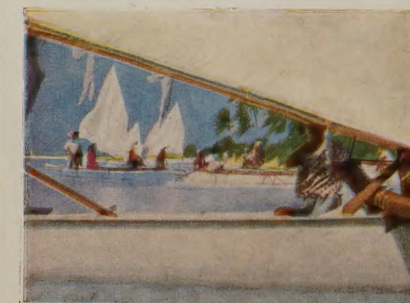
Côte Ouest

- j Km 52 : Forêt de mapé et végétation typique.
- k Km 49 : Cascade de Vaipahi.
- l Km 46 : Site des vallées de Papeari. Belle vue sur les montagnes de l'intérieur depuis le pont de Taharuu.
- m Km 33 : Vallées de Papara ; Ancien Marae de Mahaitea.
- n Km 23 : Visitez le Marae Ararahu reconstitué.
- o Km 12 : Emplacement de l'ancien Fare de Gauguin.
- p Km 4 : Route des Maraichers - Point de vue.

Ouverture d'un four tahitien. Petit cochon de lait, poissons et fruits cuits sous terre à l'étouffée, seront le menu de votre tamaaraa.

La Polynésie française

est composée de 110 îles dispersées sur une surface aussi vaste que l'Europe. L'ensemble des terres émergées correspond à la surface d'un département français.



Ph. Sylvain

Historique

1595 Découverte de l'Archipel des Marquises par l'Espagnol Mendana.

1616 Découverte de l'Archipel des Tuamotu par les navigateurs Hollandais Le Maire et Shouten.

1722 Passage du Hollandais Roggwein aux mêmes îles.

1767 Découverte de **Tahiti** par Wallis à bord du "Dolphin" (Km 10).

1768 Le Capitaine de Vaisseau de Bougainville, parti de Brest avec la frégate "La Boudeuse" et la flûte "l'Etoile", débarque à Hitiaa (Km 34).

1769 Le Capitaine Cook débarque avec mission d'observer le passage de Vénus sur le disque solaire. (Km 10).

1773 Une mission espagnole arrive du Pérou avec des Missionnaires Catholiques et s'installe à Tautira sous la direction de Don Domingo Boenechea.

1789 Le Vaisseau anglais "H.M.S. Bounty", commandé par le Capitaine Bligh, fait escale à **Tahiti**, pour emmener plusieurs milliers de pousses d'arbres à pain aux Antilles. (Km 10).

1797 Arrivée de Duff avec les premiers Missionnaires méthodistes (Km 10).

1840 La France prend possession des Iles Marquises.

1842 La Reine **Pomaré IV** de **Tahiti** se rallie au protectorat Français.

1880 Son fils **Pomaré V** fit don de son pays à la **France**.

Edité avec le concours de l'**Office du Tourisme d'Outre-Mer**
20, rue La Boétie - Paris 8°



Tahiti

Position :
17° lat. sud.
151° long. ouest.

Longueur : 60 km.

Largeur : 40 km.

Superficie : 104.215 ha.

Point culminant :
Mont Orohena : 2.241 m.

Tour de l'île : 191 km.
Par la route 120 km.

TAHITI



Edité par l'**Office du Tourisme**
de la Polynésie Française - B. P. 65 Papeete-Tahiti



Nafea fo ipoipo
Quand te maries-tu?
Paul Gauguin

...

"Le paysage avec ses couleurs franches, ardentes m'éblouissait, m'aveuglait... cela était si simple pourtant de peindre comme je voyais, sans tant de calculs, un rouge, un bleu !..."

Dans les ruisseaux, des formes dorées m'enchantaient : pourquoi hésiterais-je à faire couler sur ma toile tout cet or et toute cette joie du soleil."

Gauguin.

L'AVIATION SORT T

Vous devez savoir que **Tahiti** ne possède ni grand palace, ni casino, ni golf, ni télévision, ni spectacles de cabaret.

La lumière électrique ne fait même pas encore le tour de l'île.

Mais sa végétation luxuriante et la douceur de son climat (température moyenne 26°) en font un véritable paradis terrestre que vous aurez à découvrir en poussant votre pirogue au milieu de merveilleux fonds sous-marins ou en vous laissant prendre le soir par ces inoubliables mélodies tahitiennes, à moins que vous ne préfériez rêver au fond de votre bungalow polynésien parmi le grondement des vagues du récif.

La vie n'est pas moins chère qu'ailleurs, en Polynésie Française ; en effet, toutes les marchandises y sont importées. Mais les résidents des îles ne sont assujettis à aucun impôt sur le revenu.

L'eau qui provient des sources montagneuses y est très saine et les Tahitiens eux-mêmes très propres ne l'économisent pas.

Observez et photographiez les enfants, ils sont les rois des îles.

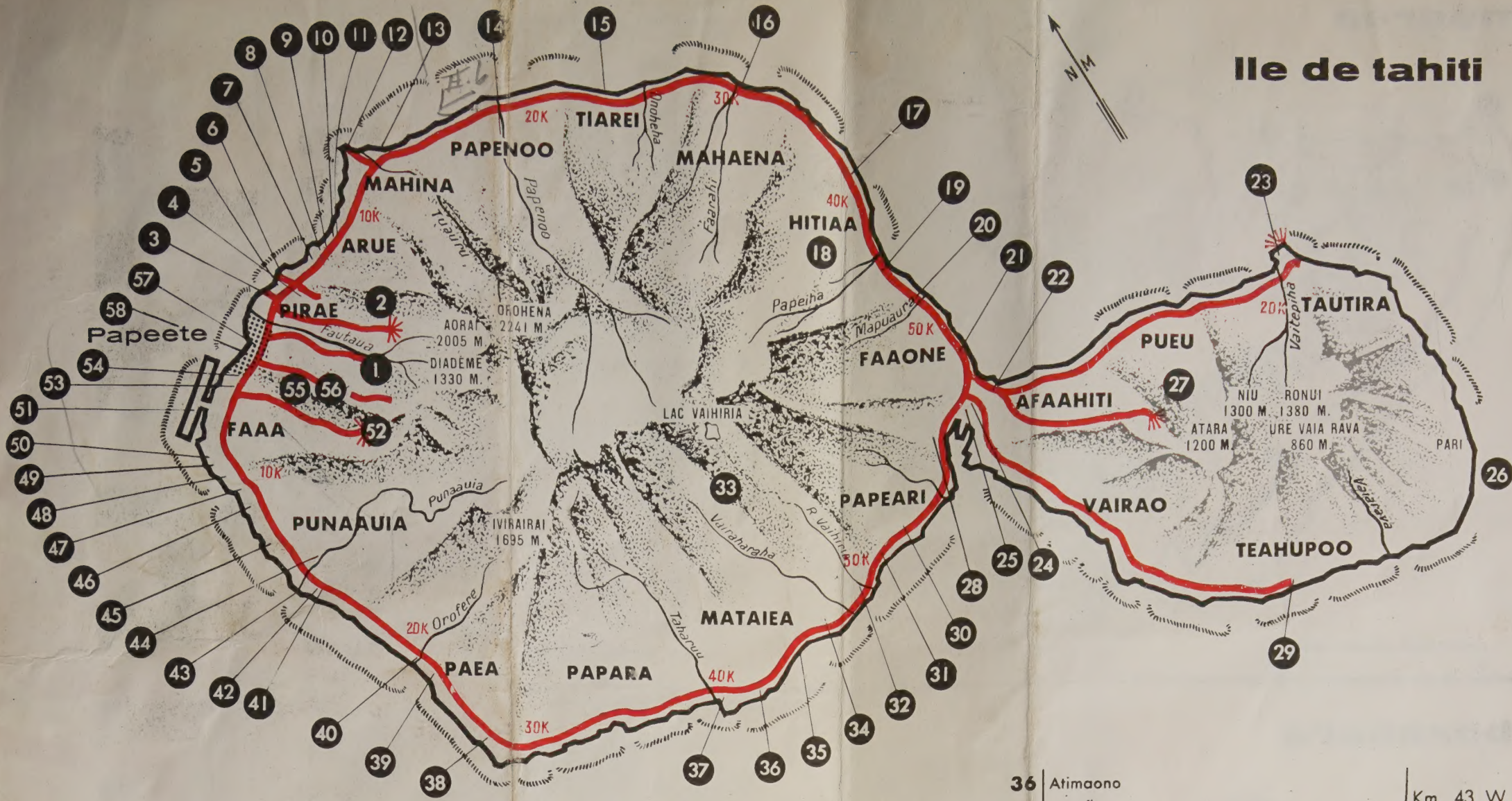


Porteur de fruits dans la vallée.

Le p...
est c...
aux l...
de l'...
tahit...
RESP...
COUT...

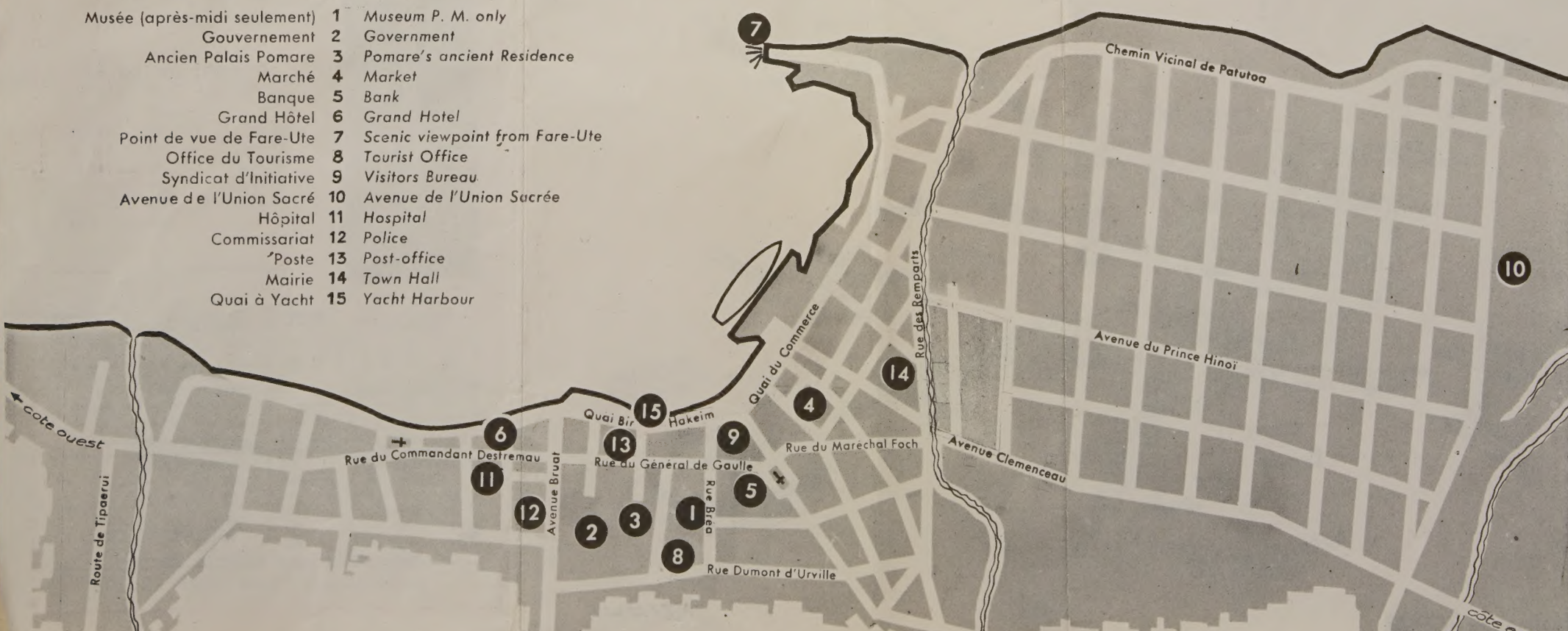
Ph. Sylv...

Ile de tahiti



- | | | |
|--|---|---|
| <p>1 Vallée de Fautau - Bain Loti - Cascades Fautau valley - Loti's pool - Waterfall Km 1,5 E.</p> <p>2 Piste de Fare Rau Ape - Point de vue (600 m.) Mountain road to Fare Rau Ape - Scenic view point (600 m.) Km. 2 E.</p> <p>3 Hôtel Taaoone - Plage de Taaoone - Ski nautique Taaoone Hotel - Taaoone Beach - Water skiing Km. 3 E.</p> <p>4 Centre d'équitation Horse Riding School Km. 3 E.</p> <p>5 Hôtel Royal Tahitien - Plage de Taaoone Royal Tahitian Hotel - Taaoone Beach Km. 3,5 E.</p> <p>6 Hôtel Heiata Heiata Hotel Km. 3,5 E.</p> <p>7 Hôtel Arahiri Arahiri Hotel Km. 4 E.</p> <p>8 Puoro Plage Km. 4,5 E.</p> <p>9 Tombeau du Roi POMARE V Tomb of King POMARE V Km. 5 E.</p> <p>10 Plages d'Arue - Ski nautique Arue Beaches - Water skiing Km. 5-6 E.</p> <p>11 Point de vue du Belvédère de Taharaa From the heights of Taharaa a breath taking view and a "photographic" must Km. 8 E.</p> <p>12 Pointe Vénus - Monument du Capitaine Cook Plage - Point de vue Point Vénus - Captain Cook's Monument Swimming from the black sand Beach Km. 10 E.</p> <p>13 Plage de Hitimahana - Bain dans la rivière Tuauru Hitimahana Beach - Tuauru River Swimming Km. 10 E.</p> <p>14 Vallée de Papenoo - Bain de rivière - Plage Excursions Papenoo Valley (Largest in the island) - River Swimming - Beach - Excursions Km. 18 E.</p> <p>15 Arahoho - Trou du souffleur - Bain de rivière Plage - Cascades Faarumai 1 km 500 Arahoho - Blow hole - River Swimming - Beach Faarumai waterfall Km. 23 E.</p> <p>16 Plage et bain de rivière de Mahaena Mahaena bridge; beach and river swimming Km. 32 E.</p> <p>17 Mouillage de Bougainville Bougainville's anchorage Km. 37 E.</p> <p>18 Cascade de Fatautia - Bain de rivière - Plage Fatautia waterfall - River Swimming - Beach Km. 45 E.</p> | <p>19 Papeiha - Plage - Bain de rivière Papeiha - Beach - River swimming Km. 47 E.</p> <p>20 Plage de Faaone Faaone beach Km. 50 E.</p> <p>21 Fonds coralliens de Faaone Under water coral gardens Km. 52 E.</p> <p>22 Hôtel-restaurant de Faratea Faratea Hotel-Restaurant Km. 58 E.</p> <p>23 Village de Tautira - Point de vue - Bain de rivière - Excursions au Pari - à l'îlot Fenuaino Relais "chez Pepe" Stevenson Lodge - Possibilités d'excursions Before crossing the isthmus make the 18 kilometers side trip to the Village of Tautira - Scenic view point - River swimming - Motor Boat Excursions to Fenuaino islet; cliffs, valley Pepe's Tavern - Stevenson Lodge - Excursions Km. 71 E.</p> <p>24 Hôpital de Taravao Taravao Hospital Km. 59 E.</p> <p>25 Gendarmerie de Taravao Police Station of Taravao Km. 59 E.</p> <p>26 Vallée de Vaioete Vaioete valley Km. 60 W.</p> <p>27 Plateau de Taravao - Point de vue Taravao plateau - Scenic view point Km. 78 W.</p> <p>28 Restaurant "Atchoun" Atchoun Restaurant Km. 51 W.</p> <p>29 Village de Teahupoo Excursions aux grottes Vaipoiri en bateau Village of Teahupoo - Motor boat excursion to Vaipoiri grotto Km. 49 W.</p> <p>30 Jardin botanique et forêt de "mape" (inocarpus edulis) Botanic gardens; forest of tahitian chestnut trees and tropical vegetation Km. 48 W.</p> <p>31 Cascade de Vaipahi Vaipahi waterfall Km. 47 W.</p> <p>32 Rivière légendaire de Vaima Vaima River Km. 47 W.</p> <p>33 Lac Vairahira Vairahira Lake Km. 47 W.</p> <p>34 Point de vue vers l'intérieur du pont de Vairahara View of interior valleys from Vairahara bridge Km. 47 W.</p> <p>35 Plage de Mataiea Mataiea Beach Km. 47 W.</p> | <p>36 Atimaono Km. 43 W.</p> <p>37 Marae Mahaatea Papara valleys, and the ancient Marae (temple) of Mahaatea Km. 39,5 W.</p> <p>38 Grotte de Maraa Maraa Grotto Km. 28,5 W.</p> <p>39 Marae Arahurahu Visit the restored Marae (temple) of Arahurahu Km. 22,5 W.</p> <p>40 Gendarmerie de Paea Police station of Paea Km. 21 W.</p> <p>41 Hôtel Tahiti Village Tahiti Village Hotel Km. 16 W.</p> <p>42 Club Méditerranée Méditerrananean Club Km. 16 W.</p> <p>43 Plage de Punaauia - Lagon de sable blanc Punaauia white sand beach Km. 15-18 W.</p> <p>44 Vallée de la Punaruu - Fortins Punaruu Valley - Forts Km. 15,5 W.</p> <p>45 Emplacement de la demeure de GAUGUIN Site of GAUGUIN's home Km. 12 W.</p> <p>46 Hôtel laorana Villa laorana Villa hotel Km. 11 W.</p> <p>47 Vaipoopoo (Bungalows) Km. 10 W.</p> <p>48 Lotus Village Km. 9,5 W.</p> <p>49 Hôtel Moana-Nui Moana-nui Hotel Km. 8,5 W.</p> <p>50 Bel Air Km. 8 W.</p> <p>51 Aerodrome TAHITI-FAAA Faaa airport Km. 5 W.</p> <p>52 Route de Pamatai - Point de vue Road leading to scenic view from heights Km. 3,5 W.</p> <p>53 Hôtel "Les Tropiques" "Les Tropiques" hotel Km. 3 W.</p> <p>54 Hôtel Tahiti Tahiti Hotel Km. 2 W.</p> <p>55 Hôtel Matavai Matavai Hotel</p> <p>56 Hôtel Tiki Tapu Tiki Tapu Hotel</p> <p>57 Grand Hôtel</p> <p>58 Hôtel Temehani Temehani Hotel</p> |
|--|---|---|

ville de papeete



- | | |
|--------------------------------|--------------------------------|
| Musée (après-midi seulement) 1 | Museum P. M. only |
| Gouvernement 2 | Government |
| Ancien Palais Pomare 3 | Pomare's ancient Residence |
| Marché 4 | Market |
| Banque 5 | Bank |
| Grand Hôtel 6 | Grand Hotel |
| Point de vue de Fare-Ute 7 | Scenic viewpoint from Fare-Ute |
| Office du Tourisme 8 | Tourist Office |
| Syndicat d'Initiative 9 | Visitors Bureau |
| Avenue de l'Union Sacrée 10 | Avenue de l'Union Sacrée |
| Hôpital 11 | Hospital |
| Commissariat 12 | Police |
| Poste 13 | Post-office |
| Mairie 14 | Town Hall |
| Quai à Yacht 15 | Yacht Harbour |

moorea



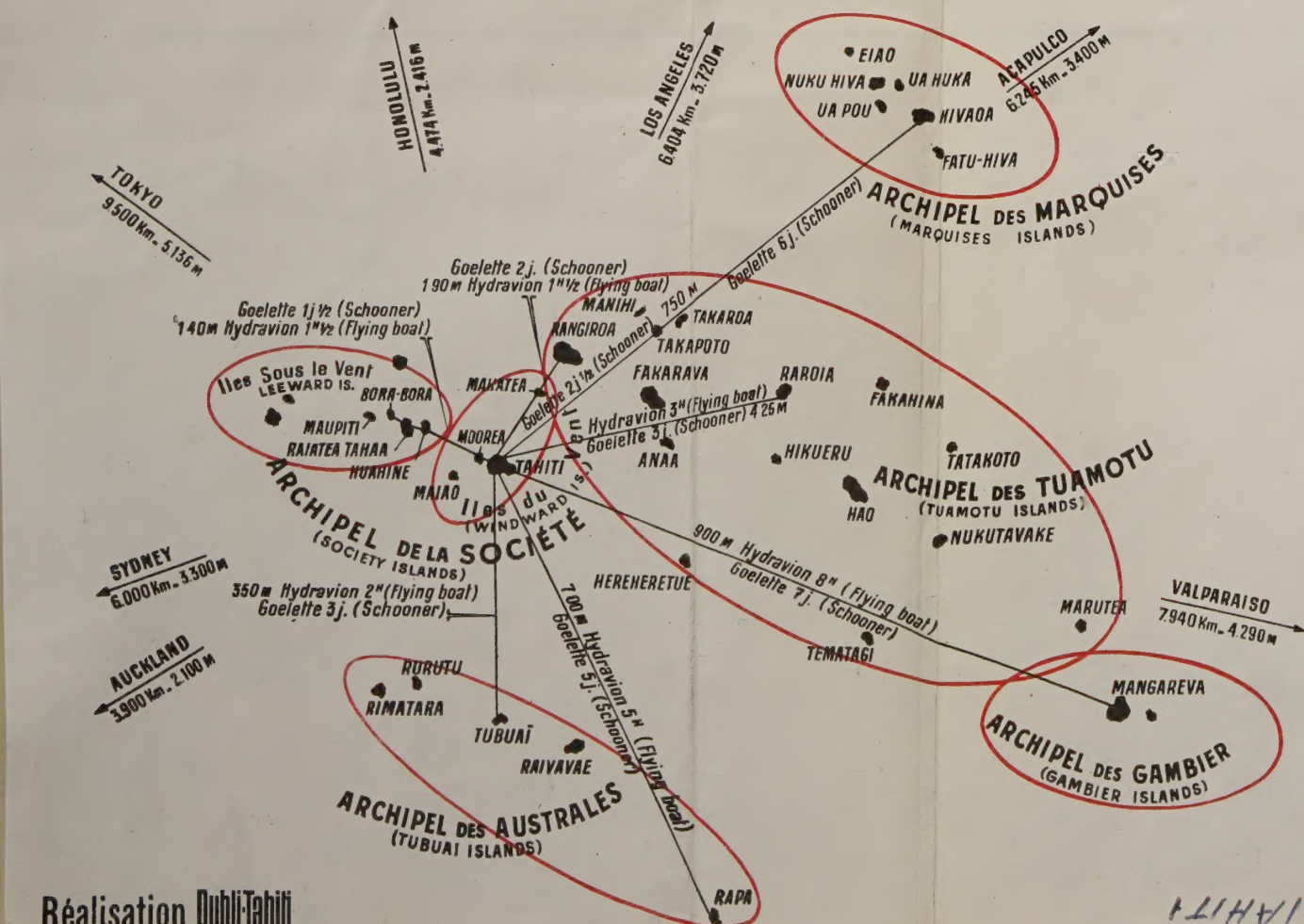
- 1 - Wharf
Wharf
- 2 - Hôtel Aimeo
Aimeo Hotel
- 3 - Hôtel Matiehani
Matiehani hotel
- 4 - Village de Temae (dances)
Temae village (dances)
- 5 - Plage de sable blanc
White sand beach
- 6 - Village de Afareaitu
Afareaitu village
- 7 - Auberge Tohivea
(chez Pauline)
Tohivea country Hotel
(chez Pauline)
- 8 - Village de Haapiti
Haapiti village
- 9 - Club Méditerranée
Mediterranean Club
- 10 - Îlots
Islet
- 11 - Village de Papetoai
Papetoai village
- 12 - Promenades
Hikes
- 13 - Village de Maharepa
Maharepa village
- 14 - Vestiges (maraes et
habitats)
Vestiges Remains (Marae)

borabora



- 1 - Centre administratif
(Postes)
Administration and Post
Office
- 2 - Infirmerie
Dispensary
- 3 - Wharf
Wharf
- 4 - Aéroport
Air field
- 5 - Restaurants-Auberges
Pona Ofe - Tiare-Tahiti
Country-Restaurants
Rooms
- 6 - Hôtel Bora Bora
Bora Bora hotel
- 7 - Hôtel Polynésie
Polynesian Hotel
- 8 - Monument Alain Gerbault
Alain Gerbault Tomb
- 9 - Cloche de Hiro
Hiro's Bell
- 10 - Plages (sable blanc)
Beaches
- 11 - Point de vue
Scenic View Points
- 12 - Ascensions et excursions
Hikes
- 13 - Marae
Sacrificial Altar
- 14 - Pêcheries
Fishing grounds
- 15 - Canotage possibilités de
ski nautique
Boating and water skiing
area
- 16 - Bassin abri pour yachts
Yachts basin
- 17 - Petite cale pour yachts
Slip way for yachts

Polynésie Française



Réalisation Publi-Tahiti

MOOREA BORABORA

Édité par l'Office du Tourisme

Table de conversions

DISTANCES

DISTANCES	
1 km	.621 miles
2 km	1.243 »
3 km	1.864 »
4 km	2.485 »
5 km	3.107 »

CAPACITÉS

CAPACITÉS	
1 litres	1.76 pints
	0.88 quarts
10 litres	2.64 US gal.
	2.20 Imp. gal.

LONGUEURS

LONGUEURS	
1 cm	.38 in
1 m	3.28 ft
	1.09 yds

POIDS

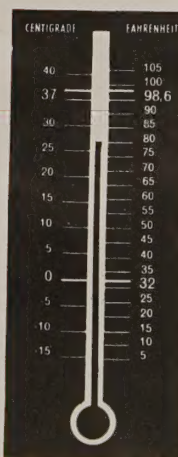
POIDS	
1 gr	.035 oz
1 kg	2.20 lbs
1 tonne	.98 tons

SURFACE

SURFACE	
1 Hectare	2,46 acre
1 Acre	0,4050 hectare

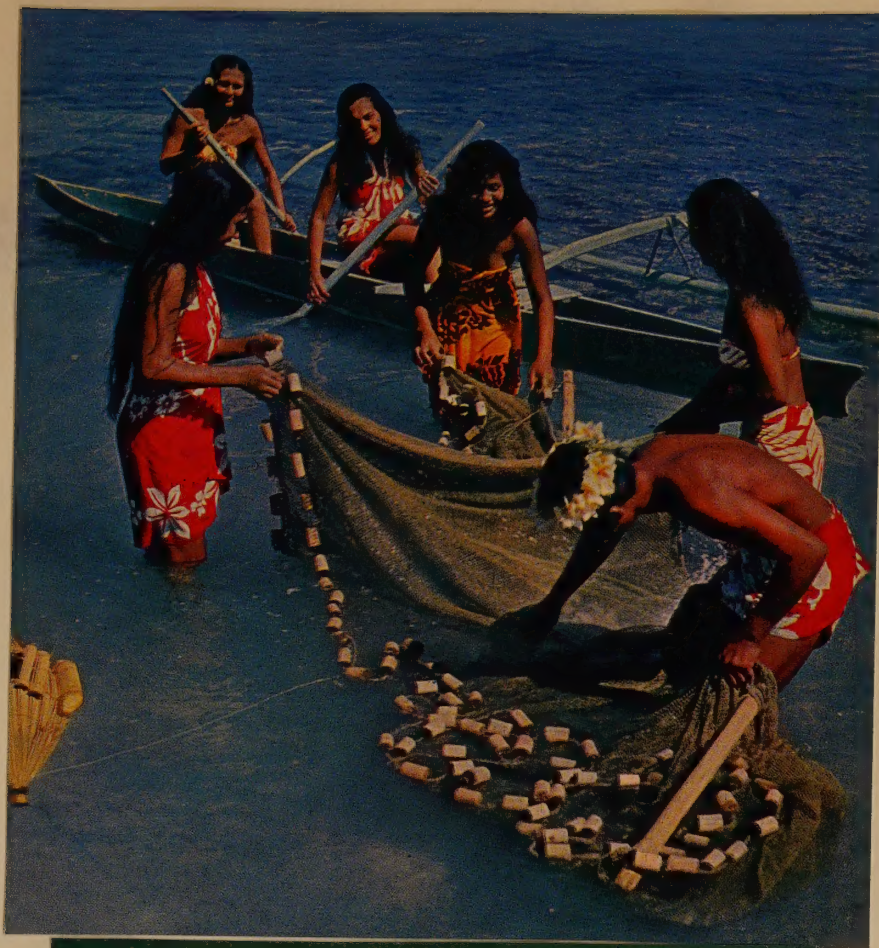
CHANGE AU 1-7-62

CHANGE AU 1-7-62		
EXCHANGE RATE ON THE 1-7-62		
	Francs C.F.P.	T.C.
US \$	87	88,20
£/ Stg	242	247,63
£/ Austr.	193	197,31
£/ N. Z.	239	245,18
£/ Fiji	216	221,10
N. F.	18,18	18,18



ROBES ET MANTEAUX DRESSES AND SUITS	FEMMES WOMEN	PRÊT À PORTER MENS' READY MADE SUITS	HOMMES MEN
Europ.	40 42 44 46 48 50	Fren.	36 38 40 42 44 46 48
Engl.	36 38 40 42 44 46	Engl.	34 36 38 40 42 44 46
Amer.	10 12 14 16 18 20	Amer.	34 36 38 40 42 44 46
CHEMISIERS ET PULLS SWEATERS AND BLOUSES		PULLS SWEATERS	
French.	40 42 44 46 48	Europ.	36 38 40 42 44 46
Engl.	32 34 36 38 40	Amer.	46 48 50 52 54 56 58
Amer.	32 34 36 38 40		
CHAUSSETTES SOCKS		CHAUSSEUSES SHOES	
Fren.	39-40 40-41 42 42-43 43-44	Fren.	36 37 38 39 40 41 42 43
Engl.	10 10 1/2 11 11 1/2 12	Engl.	3 4 5 6 7 8 9 10
Amer.	5 6 7 7 1/2 8 9 10 10 1/2	Amer.	5 6 7 7 1/2 8 9 10 10 1/2
BAS STOCKINGS			
Fren.	1 2 3 4 5		
Engl.	8 9 9 1/2 10 10 1/2		

Imprimerie "LES NOUVELLES"



TEAL Menu

Pamplemousse Glacé
Cornflakes a la Crème Fraîche



Omelette Nature
Bacon Grillé



Petits Pains au Beurre
Confiture
Café — Thé

TAHITI

Papeete

Paea

Faaone

Scale about 1:100,000

149°30

149°20

149°10

[illegible]

TAHITI

Papeete

Paea

Faaone

Scale about 1:100,000

149°30

149°20

149°10

TAHITI

Papeete

Paea

Faaone

V E N T

Scale about 1:100,000

149°30

149°20

149°10

TAHITI

Papeete

Paea

Faaone

Scale about 1:100,000

149°30

149°20

149°10

TAHITI

Papeete

Paea

Faaone

Scale about 1:100,000

149°30

149°20

149°10

TAHITI

Papeete

Paea

Faaone

Scale about 1:100,000

149°30

149°20

149°10

October 28: I am still on Honolulu time and get up at 5:50 with early light, with birds, and roosters. I take some photographs of the cabins and the hotel (K-3015) and have breakfast.

Bill Johnson had had the foresight to get an international driver's license and reserve a Hertz car. We leave about 9:00 o'clock and drive first through Papeete. The streets are crowded on this Sunday, which is also an election day. Most of the shops are closed. We start to drive clockwise around the island. The vegetation is luxuriant and there are many gorgeous flowers. After we pass Arue there are many coconut palms. I see bananas on quite steep slopes as we approach Pointe Venus (K-3016). Where the coastal plain is very narrow the soil profiles in the road cuts suggest Reddish-Brown Latosol from firm basalt.

We drive on toward Mahina. The soils are very hilly with lava and cinders in the parent material. Some of the old gullies are filled with cinders and colluvium. Then near Mahina we are again back on a broader coastal plain with many coconut palms, some mangoes, and bananas. Most of the palms have wide metal bands on them to keep the rats from getting at the fruits. I see a few Holstein-Friesian cattle. Then again at 13 km., the hills come down to the sea. Such pretty peasant homes! So many beautiful flowers! Too much to see in such a little time. (When we planned the trip we expected three days in Tahiti

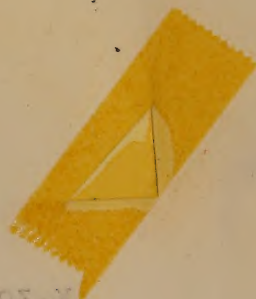
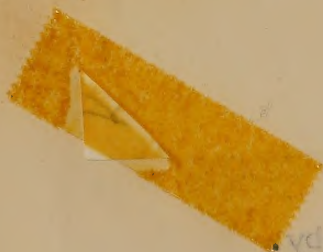


October 28, 1962. Papeete, Tahiti
Hotel lobby. (Photo by W. M. J.)



October 28, 1962. Papeete, Tahiti
Hotel maid and Professor Tavernier
(Photo by W. M. J.)

IIIV



K-3015 Tablct. Papete Hotel lobby.



K-3016 October 28, 1962. Tahiti. Near Pointe Venus.
Looking back toward Papeete.



K-3017 October 28, 1962. Tahiti. Near Pointe de
Papenoo. View looking east.

IX

K-3018 October 28, 1962. Tahiti. Near Pointe Venus.
Looking back toward Papete.

K-3017 October 28, 1962. Tahiti. Near Pointe de
Papete. View looking east.

but unhappily the airlines changed their schedules.)

As we go on the plain widens and then narrows again. We enter the Papenoo district (K-3017; K-3018; K-3019). Again we have coconut palms, bananas, and the like and some small Guernsey cattle grazing among the palms. Some of the hills to the right are nearly bare except for low ferns - too much fire (?). Then the hills are again near the sea and we come to Arahoohoo. The smooth land has coconuts, taro, bananas, and many flowering plants. I see here one of the most beautiful tropical villages by the side of a small stream that I have seen anywhere. As we go on we see more nice native homes. These have plantings of coconut palms, bananas, taro, and flowers.

Just before Haapupuri the hills are again near the sea and there are spots of black sand. But beyond there is another delta from the hills and the usual crops. Taro is mulched with the fronds of the palms. I see the odd pony.

As we pass Haapupuri the plain is wide with very luxuriant palms, bananas, and manioc, and also many pretty girls. The people are out today walking, riding on bikes, and talking with their neighbors. We pass through a typical tropical shower. After Tiarei I see a few more Guernsey cows and then the valley widens out opposite the Tahauta River. We pass Mahaena. Here there are many coconut palms. In a little way the vegetation is very beautiful with some nice forest trees along with the coconuts and



several turned. We try some more pictures of the beautiful
 K-3018 October 28, 1962. Tahiti. Papenoo. Looking
 course. up the Papenoo River. Some of the



K-3019 October 28, 1962. Tahiti. Papenoo. Looking
 toward the sea.

X

7.7

K-3018 October 28, 1962. Tahiti. Papenoo. Looking
up the Papenoo River.

7.8

K-3019 October 28, 1962. Tahiti. Papenoo. Looking
toward the sea.

At 35 km. the plain is quite wide. The soil appears to be wettish. I suppose there is a barrier beach between the delta and the sea. I see a fair-sized herd of mixed cattle that suggests Holstein, Guernsey, Shorthorn, and possibly Hereford. They are small to medium in size and are in only fair flesh. One of the farmers here has a tractor. We stop to photograph a nice home and a good taro patch mulched with palms. We discover that it is very wet around the patch. (K-3020; K-3021; K-3022).

Near Hitiaa, the background hills apparently have been severely burned. We try some more pictures of this beautiful country. I see a few outrigger canoes. Some of the houses seem to be only a meter or two above the level of the sea. We see a beautiful waterfall of the Faatuitia River (K-3023). Here there is a fairly wide plain and the plots of mixed culture are gorgeous indeed. I see a few of the white French cattle - Charlais.

Beyond Faaone, a small mixed herd of cattle graze under the coconut palms. Just beyond I stop to look at a planting of vanilla (K-3024) and a nice local home.

We stop at the Faratea Hotel for lunch just near the isthmus. It is clean and the service is good.

As we drive on a little way we stop briefly to look at a deep fresh cut in the soil. The surface has been plowed at one time. Apparently the parent material is mostly colluvium filling an old gully. The main body of



K-3020 October 28, 1962. Tahiti. South of Mahaena (37 km. post) Boys here.



K-3021 October 28, 1962. Tahiti. South of Mahaena (37 km. post). Taro patch.

K-3020 October 28, 1962. Tahiti. South of Mahana
(37 km. post) Boys here.

K-3021 October 28, 1962. Tahiti. South of Mahana
(37 km. post). Tats catch.



K-3022 October 28, 1962. Tahiti. Near Hitaa.
Taro patch near stream mulched with palm
fronds.



K-3023 October 28, 1962. Tahiti. Near Cascade.
View of waterfall, Faatuitia River.

XII

K-3023 October 28, 1962. Tahiti. Near Hige.
Taro patch near stream mulched with palm
fronds.

K-3023 October 28, 1962. Tahiti. Near Cascade.
View of waterfall, Paeutia River.



K-3024 October 28, 1962. Tahiti. South of Faaone. Patch of vanilla with local cultivator.

K-3024 October 28, 1962. Tahiti. South of
Paone. Patch of vanilla with local
cultivator.

the soil is dark brown clay (7.5YR 3/2). The surface 8 to 10 inches is very dark grayish brown (10YR 2,5/2). The structure is small to medium subangular blocky. The pH by Truog-Hellige is 5.0 to 5.5). At around 24 inches the soil is friable medium subangular blocky but becomes more nearly massive with depth. Medium pores are common. The lower soil has some irregular mottling and includes a few strongly weathered fragments.

The slope is about 5 to 10 percent. This appears to me to be a relatively young soil from mixed basaltic ash, colluvium, and cinders. Perhaps the lower part originally came from an olivine basalt. It appears that the soil has been long used in mixed cultures of tree fruits, palms, bananas, and the like. Now it affords a bit of pasture.

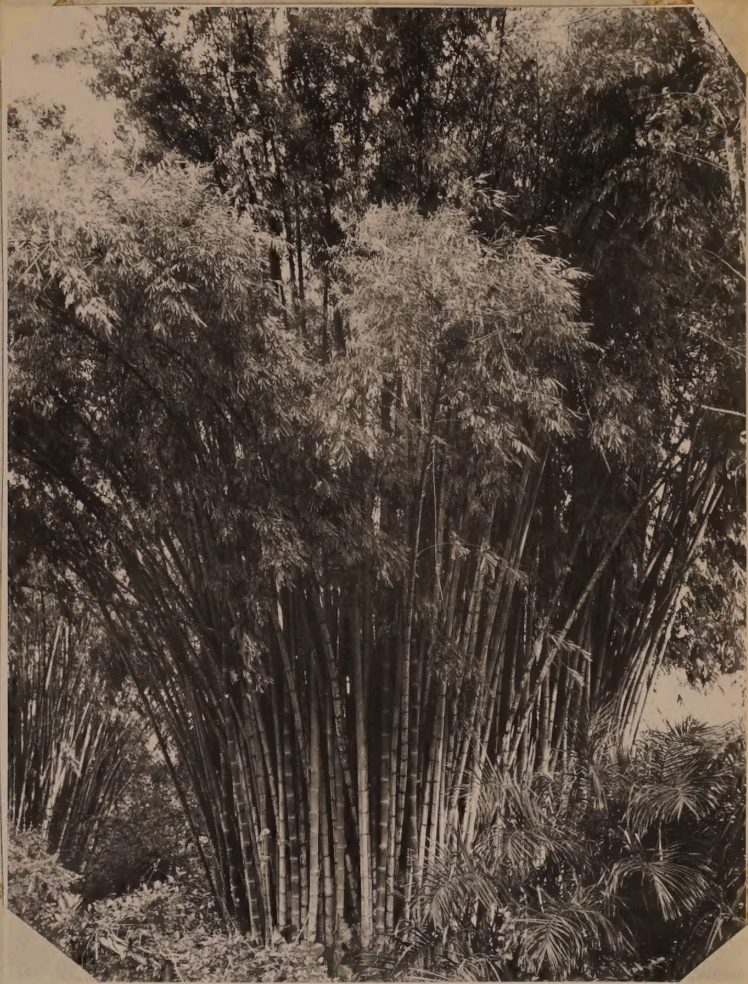
Some would probably call this a Tropical Brown soil.

Across the road is somewhat poorly drained dark brown soil from alluvium now used for coconut palms and pasture (K-3025).

Here and there we see some large bamboos (K-3026). These wettish soils of the coastal plain are good for both taro and for the combination of coconuts and pasture.

We pass Papeari - a beautiful village near the sea. A little further on at the 50 km. post I see more of the Charlais cattle grazing under coconut palms near the sea. (K-3027). Then more bananas, some coffee, many palms, and flowering plants.

X-3025 October 28, 1962. Tahiti. South of Papeete
(56 km. post). Mixed lowland pasture and
coconuts. Note steel bands for protection
against rats.



K-3026 October 28, 1962. Tahiti. Near
Papeari. Extra large bamboo.

K-3026 October 28, 1962. Tahiti. Near
Papenai. Extra large bamboo.



K-3027 October 28, 1962. Tahiti. Near 50 km.
(south) Charlais cattle on pasture under
coconut palms. (Lea of west coast).



K-3028 October 28, 1962. Tahiti. Near Mataiea.
Black sandy beach.

X-3027 October 28, 1962. Tahiti. Near 50 km.
(south) Charla's cattle on pasture under
coconut palms. (Isa of west coast).

X-3028 October 28, 1962. Tahiti. Near Mataiea.
Black sandy beach.

We stop for a moment at Mataiea to admire the homes and gardens and to look at the black sandy beach (K-3028). A nice school is nearby (K-3029). Some of these coconut palms seem not too healthy. Possibly the frond coloring is due to potassium deficiency.

When we enter the Papara District the hills toward the mountains are relatively gentle and I see some large pastures for cattle on nearly level terraces (K-3030). I note rice grass along with many others. As we move on there are more pretty gardens. The plain narrows somewhat but is still wide. Back of it are beautiful jagged mountains. Then at about km. post 32 these jagged mountains are near the sea. I now notice beans and maize in several of the gardens as well as coconuts, bananas, etc.

We drive for a considerable way with many beautiful houses and gardens along the road, the high mountains to the right, and the sea to the left. With all the barrier beaches this must be a wonderful place for surf riding.

About $3\frac{1}{2}$ km. south of Papeete we drive into the high hills on a winding road. These hills are being terraced for housing. The occupants will have a beautiful view of the city, the mountains and the sea (K-3031).

On the way we see a cutting in what was formerly called a "reddish-brown lateritic" soil, possibly a Ultalf (?) in the new system. The banding in the soil suggests ash and

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We drive for a considerable way with many beautiful houses and gardens along the road, the high mountains to the right, and the sea to the left. With all the barrier beaches this must be a wonderful place for sunbathing.

About 3 1/2 km. south of Papaya we drive into the high hills on a winding road. These hills are being terraced for housing. The occupants will have a beautiful view of the city, the mountains and the sea (K-3031).

On the way we see a cutting in what was formerly called a "reddish-brown lateritic" soil, possibly a Urtica (?) in the new system. The banding in the soil suggests ash and



K-3029 October 28, 1962. Tahiti. Near Mataiea.
Local school. (Ecole de Mataiea).



K-3030 October 28, 1962. Tahiti. Near Papara.
View of large pasture with rice grass
and others.

K-3029 October 28, 1962. Tahiti. Near Matatea.
Local school. (Ecole de Matatea)

K-3030 - October 28, 1962. Tahiti. Near Matatea.
View of large pasture with rice grass
and others.



K-3031 October 28, 1962. Tahiti. Near
Avae. View looking toward Papeete.

XVII

K-3031 October 28, 1962. Tahiti. Near
Ave. View looking toward Papeete.

cinders as the parent material. The surface soil is dark reddish brown subangular fine to medium blocky. This soil has been cultivated and is somewhat uneven. The underlying B horizon is dark reddish-brown clay (2.5YR 3/4). There are some apparent clayskins that give a mottled effect. These coatings are red (10R 4/6).

It is now about dark. We drive on and reach the hotel at 6:00 p.m. after a lovely day. I wash up, pack, take dinner, and write home.

What a wonderful day! It is impossible - absolutely impossible - for me to record the beauty of this place in words or on film. To bed at 10:00 p.m.

12
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are some apparent clay skins that give a mottled effect.

These coatings are red (10R 4/6).

It is now about dark. We drive on and reach the
hotel at 8:00 p.m. after a lovely day. I wash up, pack,
take dinner, and write home.

What a wonderful day! It is impossible - absolutely
impossible - for me to record the beauty of this place in

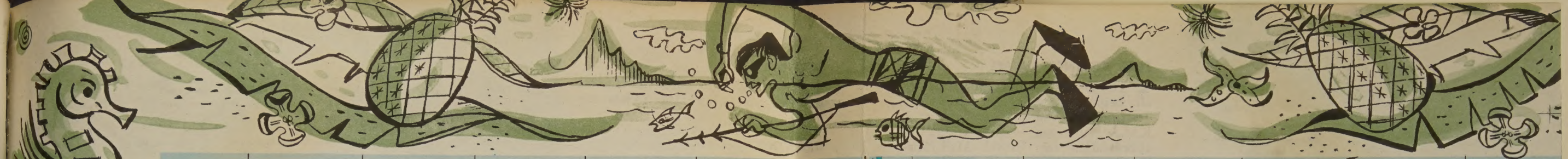
words or on film. To bed at 10:00 p.m.

October 29 and 30: Light comes fairly early here and I am up at 4:50 a.m. I finish my packing by 5:30 and manage to have a little tea while I wait for the others.

We go to the airport in a taxi. Checking in is quite informal here with no account taken for excess baggage. We have a short wait - long enough for another cup of tea.

We leave about 7:00 o'clock. This is a congenial group on the plane and we have an excellent breakfast (K3032). We stop in Pago Pago, Samoa. The United States has a miserable little air station here. It is very hot and humid. After about 30 minutes we get back on the plane and have a long taxi ride to the runway. We take off about 11:10 a.m. Auckland time and now Monday October 29 becomes Tuesday October 30 as we cross the International Date Line. Just before Fiji we fly over several colorful atolls. We are down in Fiji about 12:50 p.m. They have a nice airport here and a so-called "free port" but it is a bit expensive. (Added later: I saw in the Auckland papers that people are afraid that this airport was over-built and might not pay for itself.) We are back in the plane at 1:25 and take off at 1:45.

The wheels are down at the Auckland runway about 3:30. We are through customs quickly and are met by Norman Taylor, R. B. Miller, and a Mr. Boyle, who is some kind of public relations officer. They drive us to the Great Northern



TEAL →

TASMAN EMPIRE AIRWAYS LIMITED
in association with QANTAS and B.O.A.C.



TEAL AIRLINER NAMES

➤ TEAL airliners have Maori names all beginning with the letter "A". Traditionally, the airline's flagship is R.M.A. Aotearoa. ("R.M.A." is an abbreviation for "Royal Mail Airliner".) TEAL airliner registration letters and names are:

Electra ZK-TEA R.M.A. Aotearoa
("Long White Cloud")
Electra ZK-TEB R.M.A. Atarau
("Moonlight")
Electra ZK-TEC R.M.A. Akaroa
("Long Harbour")



TEAL EMBLEM

➤ The emblem of TEAL, New Zealand's International Airline, is a stylised representation of the Maroro, or flying fish which figures prominently in Polynesian mythology. In some areas of Polynesia it is known as the "Malolo". In the waters of many territories to which TEAL flies the flying-fish leaping from the water in fast flight is a common sight.

JET-PROP ELECTRA FACTS

➤ TEAL operates a fleet of jet-prop Lockheed Electra airliners — 400 miles-per-hour jet age transports incorporating numerous design features to speed and ease air travel.

Here are a few vital facts about the Electra:

Wingspan	99 feet
Length	104 feet 6 inches
Height (of vertical fin tip from ground)	32 feet 9 inches
Maximum Take-off Weight	116,000 lbs.
Maximum Landing Weight	95,650 lbs.
Maximum Payload	22,000 lbs.
Maximum Fuselage Width	11 feet 4 inches

Tailplane Span 42 feet 10 inches

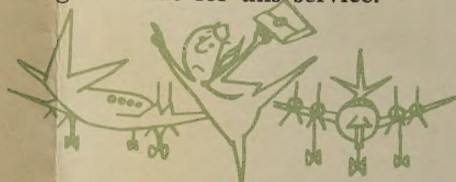
The Electra is powered with four 501-D13 Allison jet-prop engines. Each engine develops 3,750 horsepower for take-off, and this power is converted into thrust by four-bladed propellers which are 13 feet 6 inches

TOILETS

➤ The Flight Steward or Hostess will tell you where the toilets are located.

ARRIVING

➤ During flight you will be handed the necessary customs and other papers for completion. This saves delays at terminals. If you wish, we shall be pleased to help you complete the forms. When completed, some are collected and handed to the customs and health authorities. Others you retain for presentation to public authorities at the terminal. After you have disembarked, you may see your friends awaiting you behind the customs enclosure. Under customs regulations you are not permitted to greet them, except verbally, until you have been cleared by the customs officers. Once you have completed all formalities, you will find TEAL coaches awaiting to transport you to the city. At most international airports a charge is made for this service.



TRAVEL CONNECTIONS

➤ Timetable information covering connecting air services is available on this airliner and will be supplied by the Flight Steward upon request. On arrival at your destination, airport traffic officers will be pleased to assist you with travel arrangements.

At most terminals, TEAL flights connect with the services of both internal and international airlines. The TEAL service from Auckland to Nandi, Fiji, connects with TEAL's eastbound service along the Coral Route to Samoa and Tahiti. This Coral Route service in turn makes convenient connections with services north to Hawaii and the United States. The Auckland-Nandi service is also, of course, the first sector of the Southern Cross route for New Zealand passengers to North America. Passengers arriving in Australia can join Ansett-ANA or T.A.A. flights to many parts of the Commonwealth, or overseas services, including Qantas-B.O.A.C.-Air India services, to the United Kingdom, Europe, Middle East and the Orient. From TEAL terminals at Auckland, Wellington and Christchurch, N.A.C. and other services fly throughout New Zealand.

SOUTH ISLAND NEW ZEALAND





K-3032 October 29, 1962. Tahiti to Samoa. In plane en route to Samoa. Left, Williams, right, Johnson. (Tahiti was tiring).

lying islands is unloaded on a
coconut products, gold and



X-3752 October 29, 1962. Tahiti to Samoa. In-
plane en route to Samoa. Left Williams,
right, Johnson. (Tahiti was flying).



A Fijian dressed as a warrior with spear and fan takes part in a traditional dance.

FIJI

Fiji is in the south-west Pacific about 1200 miles south of the Equator; and comprises two large and some 300 smaller islands, of which about 100 are inhabited. The islands were ceded to Britain in 1874 by King Cakobau in exchange for support after a period of internal strife. Today there are about 150,000 Fijians and some 170,000 Indians among the 350,000 people living in the islands.



Picturesque and efficient, this Fijian policeman is on traffic duty in Suva.



Hibiscus Carnival Day in Suva, the main town of Viti Levu and capital of Fiji. Some of the colour and gaiety of the South Sea island life is captured in this gay scene.



Members of the Fiji Military Forces parade in full dress for an inspection. These Forces are trained and maintained with help from the Government of New Zealand.



Mobile clinics and dispensaries serve the villages. There are 25 hospitals in Fiji.



Copra from village coconut groves on outlying islands is unloaded on a Suva wharf. After sugar, Fiji's principal exports are coconut products, gold and bananas.



Sugar-cane farmlands on Vanua Levu and (left) cane outside a sugar-processing mill. Sugar, Fiji's largest export, is processed by the Colonial Sugar Refinery Company. The cane is grown mainly by Indians on their own land, or land leased from Fijians or from the Company.

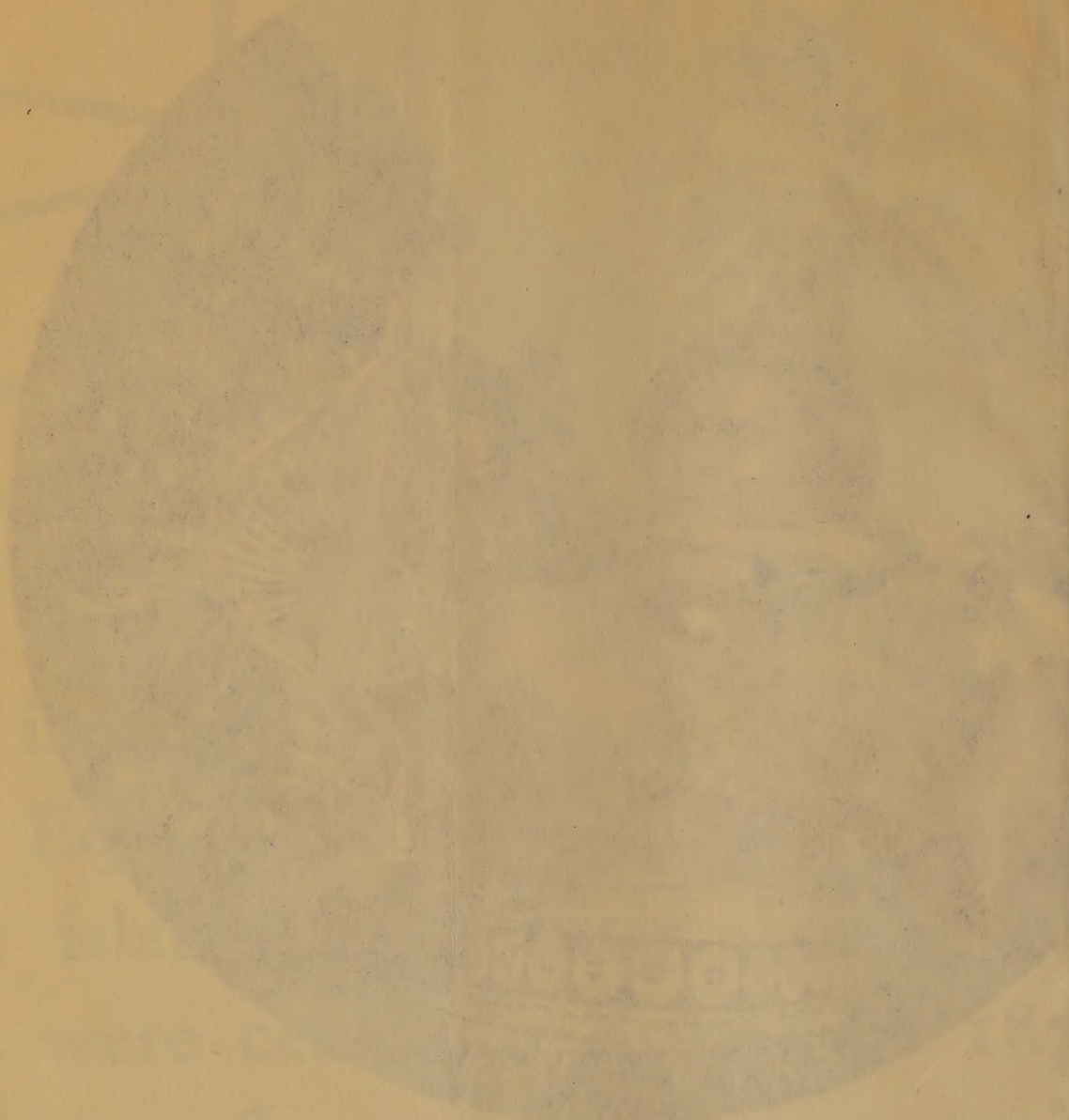


An Indian housewife buys her vegetables from a stallholder in the local market.



Intermediate education for Fijian girls is provided at this school.

From Suva radio programmes are broadcast in English, Fijian and Hindustani.

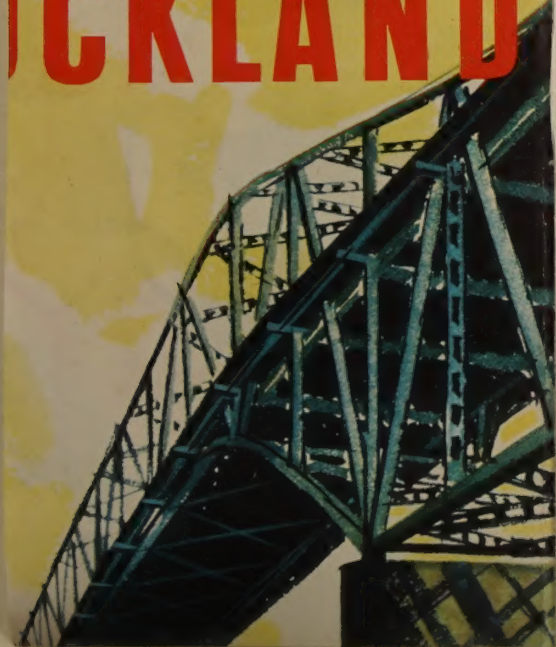


Hotel and we have to hurry down to dinner as the doors close at 7:00 p.m. It certainly is good to see Norman Taylor again. After dinner I talk with a reporter and the others for a while. Then to bed very tired in a tiny room.

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AVELLER'S GUIDE TO CKLAND



Queen City of the North

The township of Auckland
was founded on September 18, 1840,
by Captain Hobson, R.N., the first Lieutenant
Governor of the new colony of New Zealand.
He is stated to have named the city
after Lord Auckland, one of the Lords of

the area of the isthmus, was
found in the terraced walls of scoria
on the slopes of Mt. Eden, Mt. Wellington
and One Tree Hill. In July 1851, Auckland
was constituted a borough, and
20 years later was proclaimed a city.



When you're in Auckland
A.N.Z. Bank
can do much to smooth your path

As well as all the standard services you expect from a bank, A.N.Z. Bank provides a number of specialised services which you are very welcome to use when you are in Auckland on business or pleasure.

A.N.Z. Bank's Auckland Travel Department will arrange scenic tours and expeditions further afield. They will also make travel bookings and arrange accommodation ahead if you are intending to visit other towns either in New Zealand or overseas, after you leave Auckland. If you need help with passports or visas, they are the people to see, too.

correspondence service
While you're in Auckland use A.N.Z. Bank as your postal address. Letters addressed to you at A.N.Z. Bank will be forwarded to you when you are away.

Travel and Tourist Information, Sporting Facilities, Hotels, Thea

Licensed Hotels

Albert Hotel, 241 Queen Street
Central Hotel, 10 Victoria Street
Commercial Hotel, Shortland St.
Grand Hotel, Princes Street
Great Northern Hotel, cnr. Queen St. and Customs St. W.
Hotel Trans-Tasman, Eden Crescent
Royal Hotel, 28 Victoria Street W.
Star Hotel, Albert Street
Station Hotel, Beach Road
Victoria Hotel, Victoria St. W.
Waverley Hotel, cnr. Queen St. and Customs St. E.
New Criterion, Albert Street
Espianade, 1 Victoria Road, Devonport*
Mon Desir, Hurstmere Road, Takapuna*
* These hotels are both across the harbour from the

Private Hotels

Hotel Glenalvon, 16 Waterloo Quadrant
Hotel Roedean, 132 St. Stephens Ave., Parnell
Ryecroft, 26 Lower Symonds Street
Strathmore Guest House, 12 St. Stephens Ave., Parnell
Waterloo Private Hotel, 5 Allen Road, C. 1
Chateau Schubert, 17 St. Georges Bay Rd., Parnell
St. Ann's Guest House, 83 Khyber Pass Road



Sporting Facilities

Racing
Meetings are held regularly at Ellerslie and at Avondale courses.
Trotting meetings take place at the Epsom Trotting Grounds.

Golf
There are two courses available for visitors who are members of an affiliated club, Akarana Golf Club, Mt. Roskill, and Titirangi Golf Club, New Lynn. The Auckland Golf Club at Middelmore is also available to visitors provided they are introduced by a member of that club. The Municipal Links are situated at Chamberlain Park.

Swimming
In addition to the various beaches there is the Olympic Pool at Newmarket and the Parnell Salt Water Baths situated on the Waterfront Drive.

Yachting
During the summer, yachts are out on the harbour in their hundreds. A large one-day regatta is held on 29 January.

Football
In season, Rugby at Eden Park; Rugby League at Carlaw Park; Association Football at Blandford Park.

Cricket
Important matches are held at Eden Park.

Boxing and Wrestling
Important contests are advertised and usually take place weekly in the season.

Speedway Racing
Contests are held regularly at the Stadium, Western Springs.

Tennis
There are numerous clubs in the city. Championship matches are played on Stanley Street Courts.

Bowls
There are many fine greens in the city.

Tourist Bureaux

A.N.Z. Bank Travel Dept., is situated at cnr. Queen and Wyndham Sts. Branch.
Biss, Thew & Co. Ltd., 16 Victoria Road, N. 1
Thos. Cook & Son (A/sia) Pty. Ltd., 9 Commerce St.
Dalgety & Co. Ltd., 41-45 Albert Street
Henderson & MacFarlane Ltd., 56-58 Quay St. E.
Russell & Somers Ltd., 83 Customs Street E.
N.Z. Government Tourist Bureau, 97 Queen Street
Whites Travel Service, 25 Queen's Arcade, Customs St. E.
L. D. Nathan Travel Service, 76 Queen St., C. 1

Theatres

Century, 201 Queen Street
Civic, cnr. Queen St. and Wellesley St. W.
Embassy, Wellesley Street E.
Majestic, 246 Queen Street
Plaza, 232 Queen Street
Regent, 237 Queen Street
St. James, 314 Queen Street
His Majesty's Theatre (Live), His Majesty's Arcade, Queen St.
Odeon, 314 Queen Street

Parnell Road.
Anglican, St. Mary's Cathedral,
Baptist, Baptist Tabernacle,
Catholic, St. Patrick's Cathedral,
Jewish Synagogue,
Methodist,
Presbyterian, St. Andrew's,
Salvation Army, Congress Hall,
Grey's Avenue.

Main Churches

49-920
32-210
45-057
30-040
31-735
32-050
30-040
31-735
30-310
49-430

34-680
34-680
45-057
31-834
49-906
49-430

Shipping Offices

49-920
32-210
45-057
30-040
31-735
32-050
30-040
31-735
30-310
49-430

Since this guide was printed some of the telephone numbers shown have been changed. Correct numbers in all instances can be obtained by consulting the latest telephone Directory.

October 31: One can't get breakfast until 8:00 a.m. I'll have to have some fruit with my bed tea after this. After breakfast I check my tickets back to Honolulu and do a little shopping.

A little after 10:00 a.m. we begin a small tour. We visit the museum and have explanations of Mauri art from its director. Then we go to a restaurant on a small mountain overlooking Auckland. After lunch our guides take us to the top of One Tree Hill, the highest point in Auckland. This is the top of an old volcanic cone and near a small crater. It is very windy here today. Taylor tells us that the soil is a young "red loam" from ash and cinder.

We then go to the bank where I get money to pay my advance tour costs and to last me for awhile. Taylor takes me to a second-hand book shop. The lady says that she has nothing about or by Joyce. Actually she has several. I buy two books and send them home, one by Frank O'Connor and one by A. M. Sullivan.

Then I go to the little office and pay what I owe for the tour and for accommodations at Massey College in Palmerston North.

Taylor is called out so I go to my room, have some tea, and bring my accounts up to date.

Judging by the window shopping on the street, prices are quite firm in New Zealand and seem especially high for men's clothing, electrical appliances, radios, TV sets, and



Delegates to the International Soil Conference. From left: Dr W. M. Johnson (United States), Mr J. M. Williams (Hawaii), Professor R. G. Marechal (Belgium), Dr C. E. Kellogg (head of the American Soil Survey), Professor R. G. Tavernier (Belgium).

N.Z. TOO SLOW IN INDUSTRIAL

Mr E. M. Rothwell, Magistrate's Court yesterday, of a charge of investigation of the driver, of negligent driving. He fined Weir, who pleaded not guilty, £20 (costs £1 10s, witness expenses £2), cancelled his driving licence, disqualified him from driving for three years and ordered that any licence he might then

Study of Evidence

Some said that Snellgar had taken bets in the Puriri hotel on September 29 and on October 13. Snellgar, who was represented by Mr G. A. Poulgrain, pleaded guilty.

not

the like. Yet the shops seem ever so much brighter and busier than they were in 1949.

Dinner at 6:30 and soon to bed.

November 1: Rain, so our proposed field trip and lunch at a farm is called off. I walk about the town for awhile in field clothes. I stop at a recommended art shop and see two nice paintings by modern artists at 45 guineas each - a bit too much.

I return to the hotel, change, and go to the broadcasting station to make a platter for use on the National Radio. After lunch Norman and I go to look at pictures for sale at another commercial gallery. I see nothing I like. We get caught in another heavy rain and go to the Art Museum. I do not see much I like here either. Here we run into Tavernier and Marechal. We leave in a little lull in the rain and run to a tea shop and let it rain.

We are back at the hotel at 5:30. If this rain doesn't stop our field trips will be spoiled.

We have a leisurely dinner in this most bureaucratic of dining rooms. Whether this is due to labor unions or not I don't know. One can have tea for breakfast and tea for lunch but never for dinner.

A little chit chat and to bed.

November 2: Unhappily I'm up early again. My biological time clock is still set for Hawaii.

The weather looks showery again. After breakfast I buy a couple of coffee spoons and find that the buses will leave at 10:00. Actually we leave at 10:15 and go out on the Great North Road toward Titirangi. In the hills I see a luxuriant subtropical vegetation with tree ferns and the like. Nearly all the homes in the suburbs and in the country have well kept gardens. We see some farm land here and there on the easy land. (The New Zealanders use the convenient word "easy" for land that is easy to ride over with a wagon, generally with slopes under 20 percent.) We have dinner with a rural family next to a stream not far from the sea.

On the return we go through a hilly winding country with pastures on most of the slopes under 30 or 40 percent and forest in the steeper places.

We stop along the road and walk down a very steep and winding narrow path into a relict of luxuriant virgin rain forest that includes some huge kauri trees. These are altogether too large to photograph within a forest. It wasn't so bad going down but it's a real climb back to the road, up this steep and slippery path.

We are back at the hotel at 3:45 p.m. We change and go to a reception by the Mayor of Auckland in the City Hall. He has me brought into his office first and the peppy little fellow gives me an enthusiastic story about the virtues of

the city composting scheme which he has gotten established. Finally his assistant brings him out because all of the other people are waiting. Then he makes a speech to the assembled group and covers the same ground with somewhat too much length. I reply with a much shorter "pretty speech."

We are back to the hotel for dinner at 6:30. Then more chit chat with Norman and to bed.

The plane is supposed to go at 11:30 but it is delayed. We board about 1:30 and are in the air at 1:35. We stay in Wellington for about 40 minutes and leave for Christchurch about 4:30. We are met by Mr. Thompson and others who take us to the Shirley Lodge Hotel.

Dinner is at 6:00. This is by far the best room I ever had in New Zealand. We have a splendid time. Our guides on the southern tour, Mr. O'Connell and Mr. Lowe, (X-1087) about 9:00 o'clock. The lectures pick up quite a pace because they can't be postponed a single moment. (Happily they can't be so far from each other.) Then passes as I go to bed and let the boys tell me what is in the morning.

November 3: Up at 5:45. It rained last night and looks showery now. I take a suit and some of my conference papers down to Norman Taylor who will bring them to Palmerston North.

During breakfast Norman talks about the little island of Niue where the soils are naturally radioactive.

We sit around and chit chat for awhile and go out to the airport. The five of us that came together check in for the flight to Christchurch and have lunch in the airport.

The plane is supposed to go at 12:45 but it is delayed. We board about 1:30 and are in the air at 1:35. We stop in Wellington for about 40 minutes and come into Christchurch about 4:30. We are met by Dr. Thornton and others who take us to the Shirley Lodge Hotel.

Dinner is at 6:00. This is by far and away the best room I ever had in New Zealand. We have a briefing from our guides on the southern tour, Dr. O'Connor and Mr. Leamy, (K-3089) about 9:00 o'clock. The Italians kick up quite a fuss because they can't be promised a single room everywhere. (Happily they won't be in our bus for much of the way.) Time passes so I go to bed and let the boys tell me about it in the morning.

Within New Zealand

All the Highlights of a World Tour



NEW ZEALAND is the most "concentrated" wonderland of scenery and sport in the world. Here, in this land of sunshine and temperate climate, you'll enjoy superb scenery and a wealth of new experiences. You'll visit boiling mudpools, spouting geysers, caves illuminated by myriads of glow-worms . . . you'll see snow-fed mountain rivers tumbling through dense native bush, icy-blue glaciers creeping down green valleys, snow-clad peaks towering 10,000 ft. into the sky, lakes of unbelievable beauty. You'll see all this within a travelling span of about 800 miles. You waste no time in travelling long distances — you start having fun as soon as you're on New Zealand soil. Here are some of the places you MUST visit —

THE THERMAL REGION—At Rotorua and Wairakei you'll see geysers, hot springs, and other thermal wonders more spectacular than anywhere else in the world. Colourful Maori guides will show you their richly carved meeting-houses, their fascinating greenstone jewellery, and how Nature cooks their food for them in plaited flax baskets, in hot thermal pools. You'll thrill to the graceful rhythm of their traditional dances, to the soft, haunting beauty of their songs, to the natural music and grace of a happy, carefree people.

WAITOMO CAVES—Among the many beautiful caves in the world, the Waitomo Caves are said to be the loveliest, but the "Glow-worm Grotto" is unique. Slowly floating down a river in this underground fairyland, you suddenly enter a vast cavern where a canopy of millions of glow-worms shed a celestial radiance to the glassy waters below.

LAKE WAIKAREMOANA—Set in forest-clad ranges, Lake Waikaremoana ("Sea of Rippling Waters"), with its foaming waterfalls and smaller lake — Waikare-iti — is acclaimed the most beautiful of all the North Island lakes.

TONGARIRO NATIONAL PARK—Summer or winter, you'll enjoy your stay at Tongariro National Park in the luxurious Chateau. You'll ski on the slopes of Mt. Ruapehu, perhaps climb to the top to see the hot lake lapping the ice walls of the crater, play golf on the hotel course, take leisurely walks in beautiful native bush, or just relax in comfort in the mountains.

MT. EGMONT—A visit to Taranaki and Mt. Egmont is a visit to a countryside rich in lovely gardens, gently rolling farmlands, and magnificent native bush. You'll stay at comfortable hostels 4,000 ft. up the snow-capped mountain, and you'll find a restful enjoyment in New Plymouth's many lovely gardens.

NELSON-GLACIERS SCENIC HIGHWAY—Here's a motor drive you'll never forget. From sunny Nelson, with its orchards and tobacco farms, you'll begin a journey of endless variety and beauty, over rolling country to wooded uplands, through the ruggedly beautiful Buller Gorge and along miles of coastal avenues.

SOUTH WESTLAND GLACIERS—When you reach the Franz Josef and Fox Glaciers, you'll gaze in awe at these great rivers of ice as they meet verdant bushlands jewelled with lakes. You'll even walk on these glaciers for a mile or two, safe in the care of experienced guides. For side-trips, you'll visit peaceful lakes, or wander along the innumerable bush walks.

MT. COOK—No matter what your age, no matter what season of the year, you'll enjoy a visit to Mt. Cook. The rugged grandeur of the scenery is ringed by mountain peaks, with the highest, Mt. Cook, 12,349 ft. and many others towering more than 10,000 ft. into the sky. Twelve miles up the Tasman Valley beside the 18-mile-long glacier to Ball Hut is the meeting point of the Tasman and Ball Glaciers. Whatever your vacation mood — leisurely recreation, sightseeing, or active mountaineering or snow sports — you'll find them all on a visit to Mt. Cook.

THE SOUTHERN LAKES—No New Zealand holiday is complete without visiting the Southern Lakes. Here, amid towering mountain-sides and foaming cascades that flash through bronze-gold beeches, you'll stand enthralled as snowy mountain peaks and flanking woodlands are gently mirrored in the still, blue waters below. There are mysterious islets and soft, sandy beaches to be explored, lovely walks through park-like forests, motor trips through the beautiful Eglington and Hollyford Valleys.

THE FIORDLAND—A whole world of beauty is packed into the majestic Fiordland . . . the peerless grandeur of the ancient forests, mighty snow-crested mountains, fast-flowing rivers, foaming waterfalls and cataracts and lovely lakelets that jewel the woodland valleys. From the well-appointed Hotel Milford, you'll explore Milford Sound by launch visiting the Sutherland Falls — nearly 2,000 ft. and one of the highest known — and the beautiful Bowen Falls. If you enjoy hiking, you'll travel to Milford Sound in a three-day walk of 33 miles over the famous Milford Track, described by overseas visitors as "The Loveliest Walk in the World."

ANGLER'S PARADISE—New Zealand's innumerable lakes and streams teem with outsize Rainbow and Brown Trout, and it has been said that more 5 lb. to 10 lb. Rainbow Trout have been caught in New Zealand waters than in the rest of the world put together. Some go up to 12 lb. In most places the season lasts from 1 October to 30 April. Fishing-licence fees are low compared with many other countries. There are no special privileges, such as the sale of fishing rights.

BIG-GAME FISHING—Along 300 miles of coastline are prolific fishing grounds for big-game fish, including the prized 800 lb. to 900 lb. Black Marlin. Striped Marlin averaging 250 lb. and other big-game fish are also plentiful, and several world records are held in New Zealand. The season is from mid-December to the end of April. The limit bag is four swordfish a day. There are no licence fees, and the launch hire is about £12 a day.

OTHER SPORT—New Zealand is a sportsman's playground. Skiers and mountaineers from all over the world come to New Zealand. Hunting is free, and wapiti, deer, chamois, and tahr abound. In fact, you'll find most popular outdoor sports in New Zealand — mountaineering, hiking, yachting, golf, lawn bowls, tennis, swimming, surfing, to name only a few.



NZMS 76

THE WORLD'S TOURIST ROUTES TO NEW ZEALAND

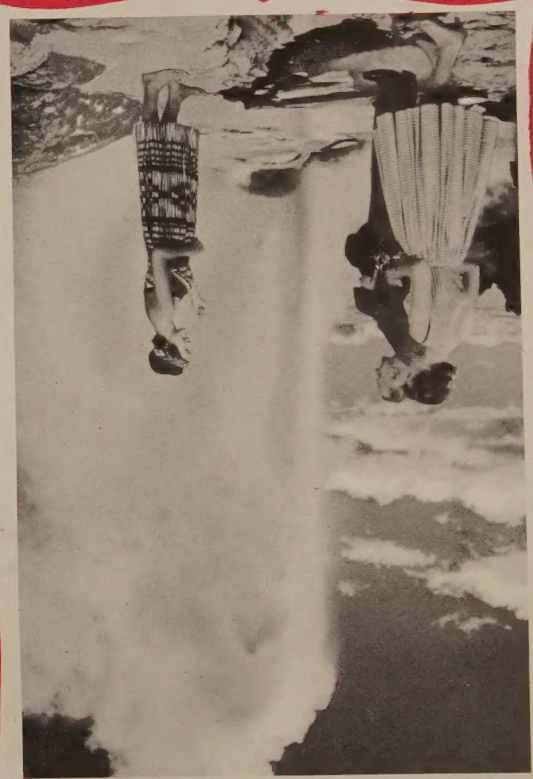
PRODUCED BY THE NEW ZEALAND TOURIST AND
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R. E. Owen, Government Printer
Wellington, New Zealand, 1961

OVERSEAS:
*** GOVERNMENT TOURIST BUREAU OF NEW ZEALAND**
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Your best insurance for a holiday that will run smoothly and will give you the most for your money is to consult your Travel Agent or the nearest representative of the

When you reach New Zealand you'll be met at a lot of money about with you while on tour. You can pay him in one lump sum to avoid carrying he'll work out just how much your trip will cost, and side-trips), he'll advise you on transfer of money, and accommodation and transport (even including taxis and transport for the whole tour, together with a detailed itinerary. All you have to do is go right ahead and enjoy yourself.

Your best insurance for a holiday that will run smoothly and will give you the most for your money is to consult your Travel Agent or the nearest representative of the



NEW ZEALAND

the GTB Way





With the greatest population density in New Zealand, **Auckland** is the principal commercial centre of the country. The city sprawls across a narrow neck of land fringed with sandy beaches and bounded by a glittering harbour. In the Pacific-warmed Hauraki Gulf many holiday islands enjoy a year round lazy-warm climate. Auckland is the perennial yachtsman's rendezvous and the city provides ideal holidays for all.



Auckland... northern gateway to New Zealand

Centre of the incredibly rich Waikato farming area, **Hamilton** is also the major airport serving the tourist attractions of Rotorua and the Waitomo Caves. Amazing Rotorua—famous for its bubbling mud pools, its boiling geysers, its hot thermal baths. In the surrounding district, a string of sparkling lakes stretch out towards the sea. The lakes are a tourist attraction in themselves, but it is the excellent trout fishing available that lures many keen fishermen into a long and memorable visit.

Pohutu Geyser Rotorua

Fifty miles from **Hamilton** are the world-famous limestone Waitomo Caves. Waitomo Cave itself contains the fabulous, unique "Glow-Worm" grotto. Aranui is renowned for the delicacy of its formations, and Ruakuri, cave of the dogs, is famous for its spectacular cathedral-like proportions.

PRINTED IN NEW ZEALAND BY C. M. BANKS LTD.



NEW ZEALAND NATIONAL AIRWAYS CORPORATION

NAC
ROUTE MAP



Lake Matheson... Westland



Apple picking... Nelson

no means old-fashioned. Christchurch is the principal N.A.C. air terminal for the South Island. From here a short trip by air or road stands Mt. Cook, at 12,349 feet, New Zealand's highest peak. Here too, is the 18 mile long Tasman Glacier, longest in the world outside the Polar regions and the Himalayas. Whether your interest lies in the majesty of the towering alps or the sight of a mile after mile of ripening corn and fat lambs, Canterbury is an unforgettable province.

Mt. Cook... from the Hermitage



Napier... East Coast playground



Weighing in... a good catch



city, rambling into the hills that ring the country's business houses. Wellington is beautiful. English city in all but location spreads Canterbury, its wide streets radiating Cathedral Square. A quiet city but by

Wellington... night in the capital city



Ninety minutes' drive from the airport at **Wanganui**, the mountain resort, Chateau Tongariro nestles at the foot of Mt. Ruapehu. The highest of three volcanic mountains in Tongariro National Park, Ruapehu offers perfect skiing from June to late October or November, with chairlifts, beginners' slopes, fast downhill runs, and a ski school staffed by international instructors. Enjoy easy walks in the invigorating atmosphere of mountain air, to delightful scenic spots within short distances of the Chateau itself.

Centre of Bay of Plenty holiday activity, **Tauranga** is one of New Zealand's big-game fishing bases. From here launches go out to the grounds at Mayor Island. At nearby Ohope beach thrilling surf carnivals are held during the summer months. Another famous big-game fishing area is located at Russell in the Bay of Islands served by N.A.C. through **Kaikōhe**. In both Russell and Tauranga, fishing launches can be hired all day for a very moderate cost.

Napier, centre of the East Coast holiday grounds, has all the attractions for a perfect continuous round of shows at the Sound Shell, on the Marine Parade. Year-round activities along the East Coast make it an ideal holiday area 365 days of the year.



Spectacle of Milford Sound... Mire Peak

Dunedin, on the edge of Port Chalmers, is a city of Scottish tradition, and renowned for its atmosphere of a true university city. Dunedin leads to Te Anau, and the walk through magnificent bush along the Milford Track. You'll see Sutherland Falls, one of the world's highest waterfalls. In summer you can drive from Te Anau through the Homer Tunnel, through unforgettable Eglington Valley to Milford Sound where breathtaking sights are the rule, not the exception. Sheer cliffs, thousands of feet high, spectacular waterfalls, the deep silent sound—and everywhere the green, fragrant bush. Milford Sound is world-renowned.



traveller's guide to

CHRISTCHURCH



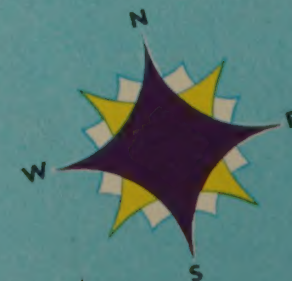
A.N.Z. BANK

AUSTRALIA AND NEW ZEALAND BANK LIMITED

CANTERBURY WESTLAND AND MARLBOROUGH

MILEAGE TABLE

	ARTHUR PASS	ASHBURTON	BLENHEIM	CHRISTCHURCH	GERALDINE	GREYMOUTH	KAIKOURA	MT. COOK	NELSON	PICTON	TIMARU	WESTPORT
ARTHUR PASS	—	139	284	87	132	60	204	253	196	302	154	120
ASHBURTON	139	—	249	52	35	199	169	154	322	267	45	269
BLENHEIM	284	249	—	197	287	260	80	408	73	18	294	217
CHRISTCHURCH	87	52	197	—	90	147	117	211	270	215	97	215
GERALDINE	132	35	287	90	—	192	207	121	360	305	22	305
GREYMOUTH	60	199	260	147	192	—	218	313	187	278	214	60
KAIKOURA	204	169	80	117	207	218	—	328	153	98	214	219
MT. COOK	253	154	408	211	121	313	328	—	481	426	132	426
NELSON	196	322	73	270	360	187	153	481	—	91	367	144
PICTON	302	267	18	215	305	278	98	426	91	—	312	235
TIMARU	154	45	294	97	22	214	214	132	367	312	—	274
WESTPORT	120	269	217	215	305	60	219	426	144	235	274	—



November 4: I am up at 6:20 after a good night, pack, and have breakfast. I don't expect to have another room in New Zealand as nice as this - bath, refrigerator, radio, electric teapot, etc. (Added later: I didn't!)

We are in the bus at 8:25 and leave for the airport. Here there are many beautiful gardens with rhododendrons, azaleas, roses, including tree roses, iris, and other late spring flowers characteristic of English gardens. We reach the airport at 9:10 and leave at 9:35. We fly west and north over the Canterbury Plain and see pastures for fat lambs, a few plowed fields, and some plantings of P. radiata. Several braided streams cross the plain. These have many cobbly and gravelly bars. During the dry periods the glacial flour and other fines blow out over the land. Most of the soils in this plain are old coarse deposits covered with loess from the braided streams. From the air one can see the relicts of the old braids in nearly all parts of the plain. (K-3033; K-3034).

Apparently we circle to the north and back again across the Plain. The hilly yellow-grey earth soils were badly eroded following over grazing, especially by rabbits. These vermin have been largely exterminated. The soils have been fertilized and oversown with airplanes and are now producing much better. (K-3035).

As we head south again from Hanmer the weather begins to look bad. We had hoped to have a clear sky for the



K-3033 November 4, 1962. New Zealand. Near Christchurch. The margin of the plain and the hills.



K-3034 November 4, 1962. New Zealand. South of Hanmer. Braided stream.

K-3033 November 4, 1962. New Zealand. Near
Christchurch. The margin of the plain
and the hills.

K-3034 November 4, 1962. New Zealand. South
of Hanger. Braided stream.



K-3035 November 4, 1962. New Zealand. Rakaia River, a braided stream now flowing with glacial flour. *Near Hanmer*

K-3035 November 4, 1982. New Zealand. Rakai
River, a braided stream now flowing
with glacial flour. West of the

mountains and the McKenzie Basin. But this is not to be and we have to stick near the east coast.

The bright green pastures dotted with sheep are beautiful. From the air they resemble white maggots on green velvet. We go southwest of Timaru. Here there are many many sheep in the southern part of the Canterbury Plain. We skirt the southern margin of the McKenzie country where the climate is much drier - yet still not too dry for some trees. What a pity now that we have to stay by the coast over a complete cloud cover. We arrive at Invercargill about 12:20. (Added later: This seemed like a normal good landing. But I read in the paper the next day that one motor had gone out in the air and that everybody was very happy that the whole plane load of soil scientists had not crashed! What you don't know doesn't frighten you sometimes.)

We are driven to the Avenal Hotel. No keys for the rooms. After tea we get into the buses at 2:00 o'clock for a look at the waterfront south of Invercargill near the "township" of Bluff. It is raining hard. This is said to be the most southern township in the world. On the way to it we see a lot of wettish soils. We are driven through Bluff to so-called "Land's End." (K-3036). The rain stops but it is cold and windy. On the return trip we visit the new harbor facility at Bluff. This is being



K-3036 November 4, 1962. New Zealand. Near Invercargill. Bluff at "Land's End." Left to right, Williams, Marechal, Johnson, and Tavernier, in the cold wind.



K-3036 November 4, 1962. New Zealand. Near
Invercargill. Bluff at "Band's End".
Left to right, Williams, Marschal,
Johnson, and Tavernier, in the cold
wind.

built by the ratepayers. Endless belts with buckets for lamb carcasses will be used to load the ships rapidly. They are modeled after the banana loaders of America. They hope to cut the time of loading by one half. Fat lamb production here has increased from about 1,000,000 in the thirties to well over 4,000,000 now.

The Harbor Board have us into their headquarters for a bit of tea. The chairman has with him his wife and little children who look just like one would expect to see on Princess Street. The little four-year-old Angela is a real beauty. We leave at about 4:45. I note sandy Podzol with ortstein along the road within the town of Bluff.

We get back to the hotel about 5:30, freshen up a bit, then go to high tea at 6:00 p.m.

In the evening we have a briefing. A reporter is there and afterwards we talk about the prospects of New Zealand's economy; probable agricultural adjustments; relations to the other developed and underdeveloped countries; and the need for more emphasis on higher education for New Zealand young people, especially the young women.

I am to bed at 9:30 in a very cold room on a very soft bed.

November 5: I am up in a clear bright morning. So I leave off the heavy underwear. This town and its people seem to have come directly from Scotland. Our young New Zealand hosts - Dr. K. F. O'Connor and Mr. M. L. Leamy - seemed a bit worried that they won't do everything correctly. Certainly they try hard to be helpful. O'Connor took some work at Cornell in fertility for the Ph. D. He likes to turn the neat phrase but sometimes gets a bit mixed up. He is typically Irish. I understand that at one time he was a priest, or at least a novitiate; but now he has a wife and five small children.

We leave Invercargill for the first day of tour at 9:17 a.m.

(Note: Copies of the tour notes and of the road maps are included in the appendix so the included explanations and copies of data are not repeated.)

I am told that in this area north of Invercargill the average farm is about 200 acres and has 1,000 breeding ewes. The ewes are mostly Romney and the rams Southdown. Such a farm would have about 10 acres of swedes that yield around 40 to 50 tons per acre. These are mainly fed in the field since pastures can be used almost the year around here. Since the seasons vary - this is a wet one - movable fences are used to help insure fairly close grazing. This year some paddocks are mowed. It's hard to make hay here because of the weather. Some make silage and more should.

SOUTHLAND AND LAKES DISTRICT

Points of Interest

Southern District

Milford Hotel
 Milford Peak (5,560 ft.)
 Milford Track
 Benmore Falls (540 ft.)
 Benmore Glacier
 Benmore Falls (505 ft.)
 Benmore Lookout
 Benmore Falls (1,904 ft.)
 Benmore Huts
 Benmore Churn (rock bridge across Cleddau River)
 Benmore Sound Track
 Benmore Pass (scenic view Doubtful Sound)
 Benmore Gate Falls
 Benmore Tunnel (1/4 mile long)

Lakes District

Lake Anau (township)
 Lake Anau Glow Worm caves

- 17 South Fiord and Gorge Falls (on Lake Te Anau)
- 18 Glade House (accommodation)
- 19 Aurora Caves
- 20 Dome Islands
- 21 Mt. Aspiring (9,975 ft.)
- 22 Arrowtown (once lustrous gold mining town)
- 23 Coronet Peak (skiing)
- 24 Queenstown (township)
- 25 Kawarau Dam (present gold dredging site)
- 26 Skippers Gorge
- 27 Manapouri (township)
- 28 Wanaka (township)
- 29 Cascade Creek Hostel (open during summer)
- 30 The Remarkables (highest point 7,688 ft.)
- 31 Moffat Peak (6,840 ft.)
- 32 Mt. Earnslaw (9,250 ft.)
- 33 Haast Pass
- 34 Benmore Hydro Station
- 35 Roxburgh Hydro Station

Tasman Sea



Reference Key

- A.N.Z. Bank Offices ★
- Highways ———
- Main Roads ———
- Railways ———
- Walking Routes ———
- Points of Interest 1 2
- Bus Routes ———

INVERCARGILL

Points of Interest

- 1 (to) Oreti Beach (6 miles) and Otago Golf Course (3 1/2 miles)
- 2 Railway Station
- 3 Police Station
- 4 Civic Theatre
- 5 (to) Anderson Park and Art Gallery - 3 miles
- 6 Central Post Office
- 7 Southland Museum
- 8 Queen's Park and Winter Gardens
- 9 Queen's Park Golf Course
- 10 Rugby Park
- 11 Motor Camp
- 12 Automobile Association
- 13 Show Grounds
- 14 Airport

DUNEDIN CITY

Points of Interest

- 1 Gardens
- 2 University of Otago
- 3 Railway Station
- 4 Bus Terminal
- 5 Museum
- 6 Public Library
- 7 Automobile Association
- 8 Medical School
- 9 Town Hall
- 10 Robert Burns Statue
- 11 Early Settlers' Hall
- 12 Chief Post Office
- 13 Masonic Temple
- 14 Law Courts
- 15 Anglican Cathedral
- 16 Knox Church
- 17 Catholic Cathedral



Lime, phosphate, and drainage are vital practices in the Southland Plain. Here there is little sulphur deficiency. Clover is the most important test plant for nutrient deficiencies. After liming, drainage, and good phosphate treatment, one may have need for potassium, boron, and especially molybdenum. Boron is especially important for the swedes. Even here cobalt is needed for animal health in a few places.

At 9:45 we stop to look at the Otonomomo peat - a slightly raised bog.

There is said to be a deep substratum of gravel overlain by silty clay. The organic material is about $4\frac{1}{2}$ feet thick. The upper 3 or 4 inches is dark brown somewhat decomposed. Then to about 30 inches the material is olive brown soft sphagnum peat. Between that and the mineral substratum the material is nearly black. (K-3037; K-3038).

Actually there is little evidence of true soil horizons. The layering may have resulted from climatic changes and associated differences in vegetation, oxidation, and accumulation.

At 10:30 we drive on past beautiful pastures well populated with ewes and their lambs. I see the odd field of spring wheat and plowed fields being prepared for swedes.

South of Maple Bush we see some nice pastures with sheep and cattle on the Waikiwi soils with podocarp forest in the background.



K-3037 November 5, 1962. New Zealand.
13 miles north of Invercargill.
Profile of Otanomomo Peat.

XXIII

4.5

K-3087 November 5, 1982. New Zealand.
13 miles north of Invercargill.
Profile of Otanomomo Pass.



K-3038 November 5, 1962. New Zealand. 13 miles north of Invercargill. Landscape of Otanomomo Peat.

VIXX



K-3038 November 5, 1962. New Zealand. 13
miles north of Invercargill. Land-
scape of Otanomomo Pass.

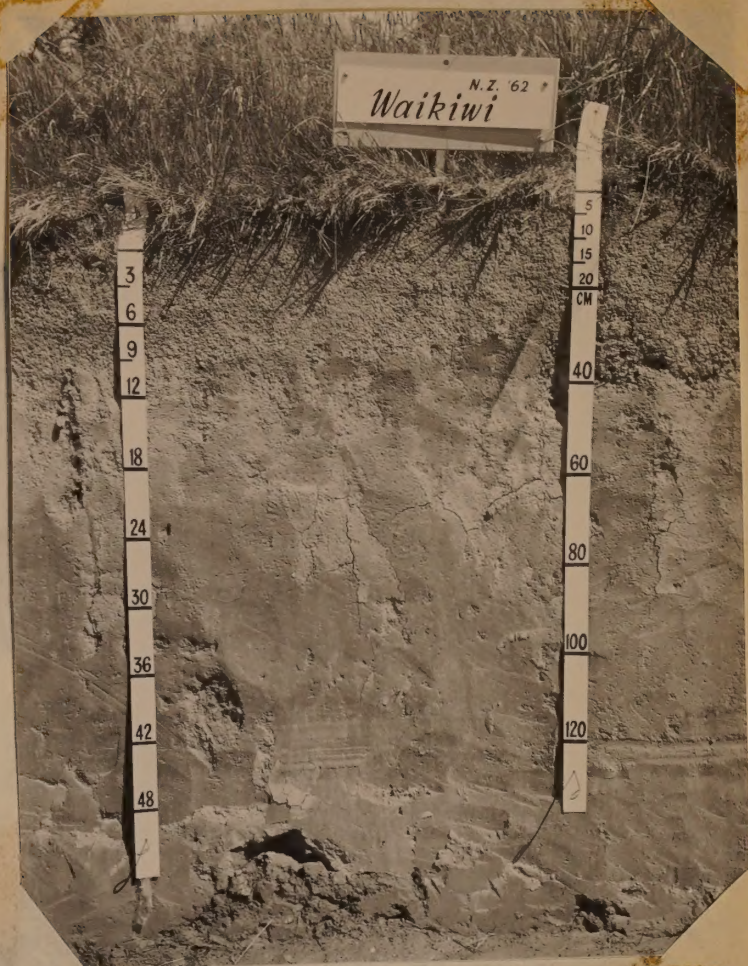
I am told that the ryegrass and white clover pastures stay down about 10 years. The length of the ley depends on the switching of fields into swedes and how much wheat is grown. They tell me that wheat yields on the average about 70 bushels per acre and many fields have over 100. One farm had 137 bushels per acre. It is a soft spring wheat. Harvest is difficult because of moisture and the grain has to be dried.

We see some windbreaks of Monterey cyprus and P. radiata.

We pass Morton Mains about 11:05 and look at the Waikiwi silt loam - a southern yellow-brown earth with cobalt deficiency. (K-3039). At least in the time available I don't quarrel much with the description given except that it doesn't emphasize enough the moderately well developed fragipan and the reddish-brown mottling in the lower part. In the present classification this is a Sol Brun Acide with moderate fragipan. I suppose it will be a Fragochrept or Fragoumbrept. (K-3040).

We look at some demonstration plots on a not very good pasture. The highest result was with 3 cwts. of 20 percent superphosphate and 3 cwts. of muriate of potash. (Here a cwt. actually weighs 112 pounds!) But they recommend 3 of the super and 2 of the muriate. This farmer had used some phosphate and potassium not very long ago and some lime. (K-3041).

We stop for a leisurely lunch at Gore. At 2:00 o'clock start loading the bus in the French fashion.



K-3039 November 5, 1962. New Zealand. Near Morton Mains, north of Invercargill. Profile of Waikiwi silt loam - a strongly enleached yellow-brown earth (Sol Brun Acide with fragipan or Fragochrept).

K-3039 November 2, 1962. New Zealand.
 Near Norton Mains, north of
 Invercargill. Profile of
 Watkiss silt loam - a strongly
 enleached yellow-brown earth
 (Sol Brun Rohde with fragipan
 or Fragochrept).



K-3040 November 5, 1962. New Zealand. Near Morton Mains, north of Invercargill. Landscape on Waikiwi silt loam.



K-3041 November 5, 1962. New Zealand. Near Morton Mains, north of Invercargill. Demonstration plots on Waikiwi silt loam - looking from O treatment to 3P. and 3K.

XXVI

K-3040 November 2, 1962. New Zealand. Near
Morton Mains, north of Invercargill.
Landscape on Waikiki silt loam.

K-3041 November 2, 1962. New Zealand. Near
Morton Mains, north of Invercargill.
Demonstration plots on Waikiki silt loam -
looking from O treatment to 2p. and 3k.

61/4140

Demonstration Trial - Plan

1962 International Soil Conference

F. Forde

Morton Mains

(Laid Down 4.10.61)

Soil Type:

Waikiwi

N

Block A			Block B			Block C		
1	8	9	5	6	7	1	8	9
1	3	4	2	3	4	2	3	4
5	6	7	1	8	9	5	6	6

2 chains
to
cutting.

- Treatments.
1. Control
 2. 1 cwt superphosphate
 3. 1 " " + 1 cwt potassium chloride
 4. 1 " " + 3 cwt potassium chloride
 5. 3 cwt superphosphate
 6. 3 " " + 1 cwt potassium chloride
 7. 3 " " + 3 cwt potassium chloride
 8. 1 cwt potassium chloride
 9. 3 cwt potassium chloride

General Instructions for the use of the

1955: International Rail Conference

E. F. F. F.

World Bank

(Laid down 1955)

Cell 1000

Weight 1000

Block A			Block B			Block C		
1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9
1	2	3	4	5	6	7	8	9

2 chains
to
1000

1955: 1000

1000: 1000

1000: 1000

1000: 1000

1000: 1000

1000: 1000

1000: 1000

1000: 1000

1000: 1000

1000: 1000

Six miles southwest of Tapanui we have a photo stop for looking at the Blue Mountains. (K-3042). Here are sheep pastures on an intergrade between yellow-grey and yellow-brown earth from loess over Early Pleistocene gravels.

We have a brief stop in light rain at the Black Gully Domain. Under the beech we see a small dab of Brown Podzolic soil and a little Sol Brun Acide.

Now the boys try to hurry because we are late. We are soon in the hills of the Otago Country and go up the Clutha Valley. We are now coming into a central area of light summer rain - perhaps the driest in New Zealand. Since lunch the weather has been alternately sunny and showery.

We see some nice little orchards with plantings of peaches, apricots, and apples. We pass Miller's Flat and reach Alexandra about 5:25 but since this is a small town we have to go on to a pub in Cromwell, which we reach at 6:00 p.m. We have dinner at 6:30 and I discover we have to go back to Alexandra for some kind of "do" sponsored by the Mayor! Just after dinner a bus like ours stops in front of the hotel and I am astonished to see Dr. and Mrs. Wheeting and Dr. and Mrs. Hendricks who are on a tour bus just ahead of ours. So three bus loads of us are to be at the "do" in Alexandra.



K-3042 November 5, 1962. New Zealand. Six miles southwest of Tapanui. View into Blue Mountains. Pasture on yellow-grey and yellow-brown intergrade on loess over Early Pleistocene gravels.

K-3042 November 5, 1962. New Zealand. Six miles southwest of Tapanui. View into Blue Mountains. Pasture on yellow-grey and yellow-brown intergrade on loess over Early Pleistocene gravels.

We leave for the "do" at 8:00 o'clock. A reporter corners me for most of the time but I chat with old friends and meet some new people. I could have done without this. We have the long drive back and I get to bed at 11:30.

The Otago Daily Times
Dunedin N.Z. 6 Nov. 1962

Soil Science Is Vital To Growth Of Grasses

Staff Reporter

ALEXANDRA.—Without the application of science New Zealand would not have had many good grasses, Dr Charles E. Kellogg, of the United States Department of Agriculture, said last night.

Dr Kellogg, assistant administrator of the Soil Conservation Service, and in charge of the United States Soil Survey since 1934, was in Central Otago touring with delegates to the International Soil Congress to take place in Palmerston North next week.

"New Zealand has almost ideal conditions for grasses, provided you have a soil bureau," he said.

The chemicals used made up for deficiencies which were once a major factor in our soils, but not necessarily for plant growth.

"Mixed up with these factors, you must have a programme to protect soils, crops and animals from diseases.

"This, too, is the realm of the soil scientist; facial eczema in sheep is caused by a soil organism, and this was discovered in New Zealand," Dr Kellogg said.

"Every acre in the world

has got to have four things in proper relationship with one another, and each kind of soil is a unique combination of these.

1. "There must be a proper level of nutriment that plant roots can take from the soil.

2. "Plants must have water when they need it—and this involves drainage as well as irrigation, as too much water can be just as harmful as not enough.

3. "There must be a variety of crops, with the genetic ability to respond to the environment.

4. "There must be disease and insect control—and it is here that crop rotation is needed," he said.

Crop rotation was not always a good thing. Less than one-third of the world's food supply was from areas of crop rotation.

Dr Kellogg said that in New Zealand particularly the soil scientists had thus played a

major role in the development of agriculture.

Dr Kellogg was speaking at a conversazione attended by 63 overseas delegates to the congress, and 20 local officers and their wives.

Three tours have been visiting Central Otago, inspecting local soils. Smaller parties visited the Old Man Range and phosphate trials at the Crown terrace near Queens-town yesterday afternoon.

"You are going to have to make adjustments to this country; don't eliminate dairy farming, but switch

more to beef and fat cattle—grow maize to fatten them." This was one of the suggestions made by Dr Kellogg at an interview.

Dr Kellogg warned that New Zealand would have to look to Japan to take its produce.

"Great Britain is going to join the European Economic Community—at least I hope and pray so.

"You people will have to look to Japan. Did you know that it increased its gross national product by 18 per cent last year?" he asked.

Soil Scientists Big Role In Agriculture

The Evening Star

Dunedin, N.Z.

6 Nov., 1962

Soil scientists had played a major part in the development of agriculture in New Zealand, according to Dr Charles E. Kellogg, of the United States Department of Agriculture.

Dr Kellogg was speaking in the Alexandra War Memorial Hall last night to 63 overseas delegates to the International Soil Conference touring the South Island before the conference opens at Massey Agricultural College, Palmerston North, on November 13. Twenty local agricultural scientists and their wives were also present.

Without the application of science the Dominion would not have had many good grasses, Dr Kellogg said.

"New Zealand has almost ideal conditions for grasses, provided you have a soil bureau," he said.

The chemicals used made up for deficiencies which were once a major factor in our soils, but not necessarily for plant growth.

"Mixed up with these factors, you must have a programme to protect soils, crops, and animals from diseases.

"This, too, is the realm of the soil scientist; facial eczema in sheep is caused by a soil organism, and this was discovered in New Zealand," Dr Kellogg said.

ESSENTIALS

"Every acre in the world has got to have four things in proper relationship with one another, and each kind of soil is a unique combination of these.

1. "There must be a proper level of nutriment that plant roots can take from the soil.

2. "Plants must have water when they need it—and this involves drainage as well as irrigation, as too much water can be just as harmful as not enough.

3. "There must be a variety of crops, with the genetic ability to respond to the environment.

4. "There must be disease and insect control—and it is here that crop rotation is needed," he said.

Crop rotation was not always a good thing. Less than one-third of the world's food supply was from areas of crop rotation.

November 6: I am up at 6:00. The morning is cold, gray, and cloudy. This little room is very cold but the bed is fine. I have tea at 7:00 and breakfast at 7:30. I take a little walk to look at the Clutha River. (K-3043). Then we have an official photo and leave in the bus at 9:00.

(Note: Since we are staying at somewhat different towns than indicated in the tour notes, one needs to consult the notes by place names rather than by the mileage given.)

We drive northeast of Alexandra into the hills. These hills were denuded by rabbits, which were destroyed about 5 or 6 years ago. The vegetation is now coming back slowly following the erosion. Runoff is reduced and soil development is now going ahead again. The steep land is used only for early spring grazing. The extremes of temperature are -3.5 to 94°F. The soils are said to be mainly brown-grey earth on thin loess over gravels in the valley. As the amount of rain increases from around 13 inches here, one expects yellow-grey earth with a weak fragipan. Above 30 inches of rain are the yellow-brown earths. We are told that this zonality is evident vertically when going up the mountains.

We have a good view of the old terraces here from the hill. (K-3044). The lowest level is about 15,000 to 20,000 years old; the intermediate terraces are Early Pleistocene, about 50,000 to 100,000 years old; and



K-3043 November 6, 1962. New Zealand. Cromwell.
Looking up the Clutha River.

MS-3043 November 6, 1962. New Zealand. Cromwell.
Looking up the Clutha River.



Cromwell, November 6, 1962

Front:

Dudal; Grobler; O'Connor

Back:

Viets; Stoneman; Saunder; Williams; CEK; Mrs. Swaby; Schlichting;
Grant; Jensen; Mrs. Viets; Tavernier; ----; Glentworth; Loxton;
Marechal; Thomas; Swaby

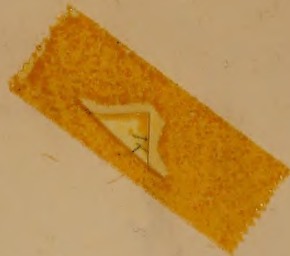


K-3044 November 6, 1962. New Zealand. Near Alexandra. View looking west from high hill east of Alexandra. Note terrace levels.



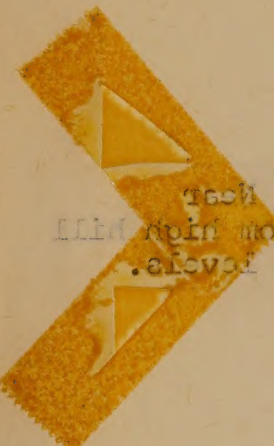
K-3045 November 6, 1962. New Zealand. Near Alexandra. Site of Conroy sandy loam.

XXIX



November 6, 1962. New Zealand. Near
Alexandra. View looking west from high hill
east of Alexandra. Note terrace levels.

K-3044



November 6, 1962. New Zealand. Near
Alexandra. Site of Conroy sandy loam.

K-3045



the still higher terrace is probably pre-Pleistocene.

In front of the terraces on this side of the river one sees scars of old gold mining by sluicing. In fact, there are remains of many of these miner's ditches, or "runs" as they are called here, throughout much of this country. Now runs are made for irrigation on the lower terraces. And there is some gold mining with modern dredging equipment along the stream.

We are told that these unirrigated soils are very low in nitrogen. A big effort is being made to get legumes established - lucerne below 20 inches of rainfall and trifolium above. Above 20 inches there is enough rain to permit aerial sowing and fertilizing. In this central Otago Basin, all of the soils, both dry and humid, appear to be deficient in sulphur. Most of the natural sulphur is in the organic matter of the soil. Less than one pound per acre per year has been measured in the rainfall. Thus the first requisite is sulphur fertilization. After that phosphorous gives responses in the humid areas but not in the dry areas. As one goes from the dry to the humid, the amounts of both organic phosphorous and total phosphorous in the soil go down. Here they found that the Truog test for P corresponds well with response and is useful for giving recommendations.

On the drier areas they use about 50 pounds of sulphur per acre as gypsum. They receive 4,500 pounds of dry lucerne with treatment and only 500 pounds without it.

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per acre as gypsum. They receive 4,500 pounds of dry
lucerne with treatment and only 500 pounds without it.

Some of this discussion is a bit inconsistent. They apparently add 400 pounds of sulphur or its equivalent to a ton of superphosphate to get a mixture that has 180 pounds of phosphorous. Partly I guess the New Zealanders cannot imagine fertilization without superphosphate whether the soils need it or not.

There is no cobalt deficiency here but boron, zinc, and iron are sometimes needed on fruits. Zinc sprays are common.

It is important that the added gypsum or sulphur be very fine. I am told that sulphur is costly so they import gypsum from Australia.

Light liming on the surface is used to establish lucerne but except for this there is no response to lime in either the dry or humid parts.

In the Central Otago Lake district they have serious selenium deficiency. By appropriately dosing the ewes with selenium they raised the lamb-ewe ratio from about .50 to about 1.15. Animals on the yellow-grey earth soils have been treated with selenium for some years.

We look now at the Conroy sandy loam, which is well described in the guide sheets. (K-3045). This they call a weakly leached brown-grey earth. It is somewhat similar to our Non-Calcic Brown but has too much of a solonetzic B. It would probably be a Natrustalf in the new system. The

soil seems to be developed from local alluvium and colluvium.

- A₁ 0 - 2" Light brownish gray fine sandy loam with weak granular structure; friable and mellow (10YR 6/2, dry; 10YR 3/2, moist).
- A₂ 2 - 14" Dark grayish brown (2.5Y 4/2, moist) fine sandy loam; slightly firm.
- B₂ 14 - 22⁺3" Olive brown compact dense silt loam (?); wavy lower boundary; hard to dig; breaks out in coarse prismatic peds; weakly mottled; (ped faces 2.5Y 4/3, moist; coatings of peds 10YR 3/2). This seems to be a solonetzic B and the lower boundary of the horizon seems to be from unconforming material.
- D 22+" Stratified sand and gravel. Some apparent lime accumulation in upper part.

I try to get some photos of the recovery after the rabbit devastation. Only a very few tussocks escaped. Here they have lucerne plots, along with a bit of trefoil and weeds. Inoculation of the lucerne seeds is essential. Possibly some of the good effect of the sulphur is partially due to correction of this high exchangeable sodium.

After all of these lectures we are again so far behind that too little time remains to describe the soil in detail. O'Connor will need to get tougher. We stop to look at the Manorburn sandy loam which looks like a somewhat solodized-Solonetz. (K-3046). In the new system this may be another and wetter Natrustalf. The site is on the lower part of a 2 to 4 percent slope of local alluvium and colluvium.

soil seems to be developed from local alluvium and col-

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A₁ 0 - 2" Light brownish gray fine sandy loam with weak granular structure; friable and mellow (10YR 6/2, dry; 10YR 3/2, moist).

A₂ 2 - 14" Dark grayish brown (2.5Y 4/2, moist) fine sandy loam; slightly firm.

B₂ 14 - 22" Olive brown compact dense silt loam (?); wavy lower boundary; hard to dig; breaks out in coarse prismatic beds; weakly mottled; (ped faces 2.5Y 4/3, moist; coatings of beds 10YR 3/2). This seems to be a solonchalc B and the lower boundary of the horizon seems to be from unconformable material.

D 22" Stratified sand and gravel. Some apparent lime accumulation in upper part.

I try to get some photos of the recovery after the

rabbit devastation. Only a very few tussocks escaped.

Here they have lucerne plots, along with a bit of trefoil

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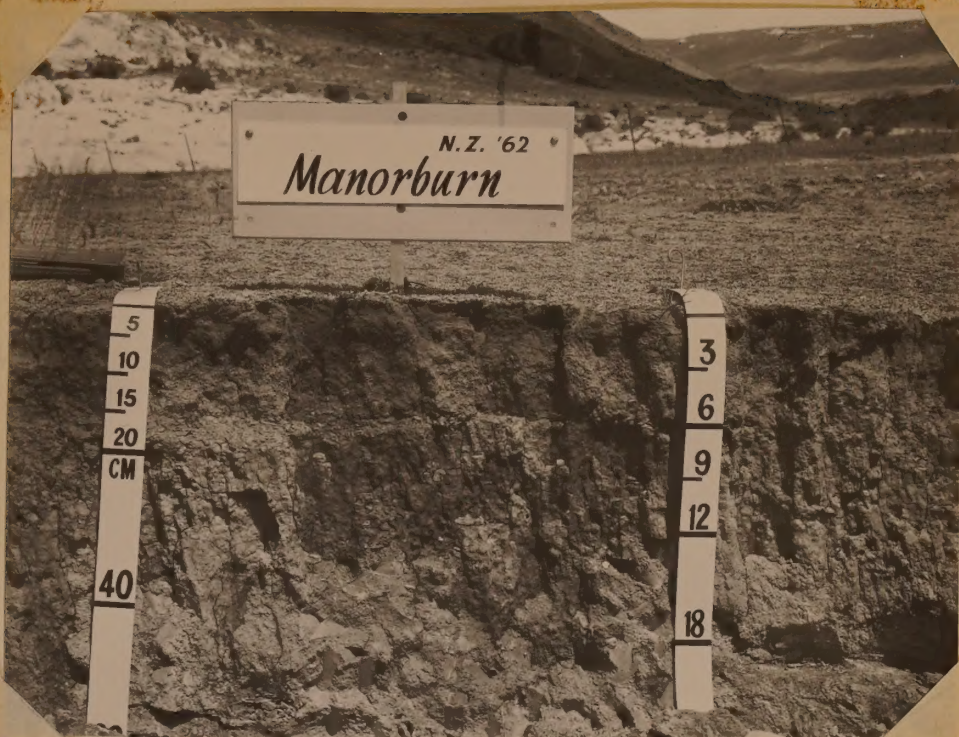
O'Connor will need to get together. We stop to look at the

Manorburn sandy loam which looks like a somewhat solonchalc-

solonchalc. (K-3048). In the new system this may be another

and water Natrustall. The site is on the lower part of a

2 to 4 percent slope of local alluvium and colluvium.



K-3046 November 6, 1962. New Zealand. Near Alexandra. Profile of Manorburn sandy loam - a wet Natrustalf (?)



K-3047 November 6, 1962. New Zealand. Near Alexandra. Party at site of Manorburn Soil.

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K-3046 November 6, 1962. New Zealand. Near
Alexandra. Profile of Manotutu valley
foam - a wet waterfall (?)

K-3047 November 6, 1962. New Zealand. Near
Alexandra. Party at site of Manotutu
Soil.

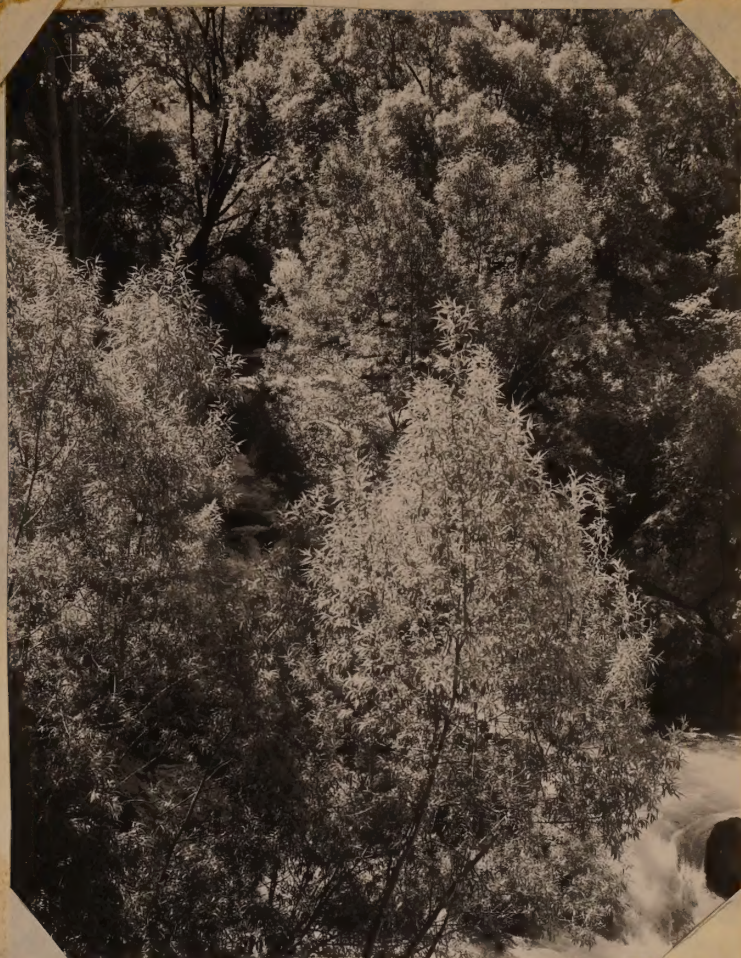
- | | | |
|-----------------|-----------|--|
| A ₁ | 0 - 2" | Very dark grayish brown (10YR 3/2, moist) fine sandy loam with a weak granular structure; mellow. |
| A-B | 2 - 8" | Transitional; very dark grayish brown sandy clay loam with poorly developed angular blocky structure tending toward massive. |
| B | 8 - 17+4" | Dark grayish brown fine sandy clay; coarsely prismatic with good shiny surfaces and no clear column tops. |
| C _{ca} | 17+" | Nearly white, sticky, salty, calcareous fine sandy clay. |

This is an ordinary saline, slightly solodized-Solonetz. Like all others, the profile is irregular. (K-3047)

While the party assembles I walk on a ways and then get into the bus. We stop for lunch and get into the bus again at 2:00 p.m. While we go west and pass an irrigated sheep pasture; I think I have never seen so many sheep per acre on a pasture. The wild rose briar here is a big nuisance. As we go on west toward Queenstown we see many of the old mining sluices on the hills.

The road goes along the Kowarau River. We cross a stream named after one of the famous girls of the gold mining days - the Roaring Meg. (K-3048). Along here there are some beautiful examples of mud flows. (K-3049). We see many glacial features in the high hills, and some nice farms on the terraces near Arrowtown. Also some beautiful hawthorne hedges just coming into bloom. Formerly there was a great deal of individual gold mining here.





K-3048 November 6, 1962. New Zealand.
West of Cromwell. A view up the
stream. The Roaring Meg.

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X-8048 November 6, 1962. New Zealand.
West of Cromwell. A view up the
stream. The Roaring Meg.



K-3049 November 6, 1962. New Zealand. West of Cromwell. Breaks on edge of the Kawarau River. Note mud flow from high center in old cirque. (Slope of Mt. Edward).



K-3050 November 6, 1962. New Zealand. Frankton. Mud flow and slips on mountain.

11XXX

November 4, 1962. New Zealand. West of
Cromwell. Breaks on edge of the Kawarau
River. Note mud flow from high center in
old cirque. (Slope of Mt. Edward).

November 6, 1962. New Zealand. Franklin.
Mud flow and slips on mountain.



K-3051 November 6, 1962. New Zealand.
Frankton. Another view of mud flow
and slips on mountain.



K-3052 November 6, 1962. New Zealand.
Frankton. View of arm of big lake.

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K-3051 November 6, 1962. New Zealand.
Frankton. Another view of mud flow
and slips on mountain.

K-3052 November 6, 1962. New Zealand.
Frankton. View of arm of big lake.

We cross the Shotover River and enter Frankton. Here are some more nice views of mudflows and slips. (K-3050; K-3051; K-3052.)

We drive on down to Queenstown and walk in the beautiful gardens that look out over Lake Wakatipu. (K-3053).

People get dispersed a bit in the shops and the parks but at 5:30 we go up the hill to a community hall for high tea.

We leave for our hotel in Cromwell at 6:35 and get back at 8:00 p.m. On the whole this has been a pleasant day. A little chit chat and early to bed.



K-3053 November 6, 1962. New Zealand.
Queenstown. Bowling on the green.

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K-5053 November 6, 1982. New Zealand.
Queenstown. Bowling on the green.

November 7: Up at 6:15, pack and write home. During breakfast the sky clears. We leave Cromwell for Ranfurly about 8:45. Some of the irrigation races out of the hills are made in staircase fashion to reduce the velocity of the flow.

We turn off to the northeast near Clyde and drive over the high intermediate terrace, which has at least some patches of solodized-Solonetz. The soil here is called a shallow brown-grey earth from loess over gravels of granitic schist. We drive on to the Mouther[^] Sheep Station where they have a sulphur demonstration on the Pigburn fine sandy loam. (K-3054). This is said to be at the moist end of the Brown-grey earth. The fan is a bit moist now.

Mr. T. C. Ludecke shows the effects of sulphur on non-irrigated lucerne. He has a factorial experiment with the 4 rates of sulphur - 0, 25, 50, and 100 - and 4 rates of phosphorous. He had no response to phosphorous alone or with sulphur. The sulphur response is very striking indeed. Fifty pounds to the acre does the job. Here they had better results with gypsum than with elemental sulphur. He thinks the soil may hold the sulphur more strongly. (?).

This private station will expand lucerne. They now have about 10,000 sheep including a large stud flock. If they operated only for wool and meat they could carry 12,000 to 13,000 ewes. They use hay only for the winter feed of hoggets and studs.



K-3054 November 7, 1962. New Zealand. Near Alexandra. Demonstration of sulphur applications on the Pigburn fine sandy loam - on the moist side brown-grey earth. Center without sulphur; left 100 pounds to the acre; right 50 pounds to the acre.

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K-3024

November 7, 1982. New Zealand. Near
Alexandra. Demonstration of sulphur appli-
cations on the Piharu fine sandy loam - on
the moist side brown-grey earth. Center
without sulphur; left 100 pounds to the
acre; right 50 pounds to the acre.

We travel back on this same big terrace or fan. It had accelerated erosion before the recent rabbit control. We go to the site of the Lowburn loamy sand a little east of Alexandra. This is said to be a weakly leached brown-grey earth with claypan. This so-called claypan is irregular and discontinuous. The parent material is banded sand, gravel, and cobbles with an irregular blanket of loess. The soil has an irregular horizon of lime accumulation.

In fact in this pit one can find whatever he is looking for.

The surface 3 to 4 inches is olive brown (2.5Y 3.5/2, moist), light fine sandy loam with very weak granular structure. This is underlain by a kind of A₃ dark yellowish brown (10YR 5/3) gravelly, cobbly, light sandy loam. This merges in places into stratified sand and gravel, much of which is reddish brown (2.5YR 4/4). Under the A₃ there may be some fibres. The B mentioned in the guide is an irregular, discontinuous, reddish brown (5YR 4/4) sticky clay, massive to weakly angular blocky with clayskins on the ped surfaces. At the site this layer is several inches thick, thin, or absent. Irregular bands of it even underlie the stratified sand in places. (K-3055; K-3056).



K-3055 November 7, 1962. New Zealand.
A little east of Alexandra. Profile
of Lowburn loamy sand in the "leached
brown-grey earth with claypan."
(Typustalf(?) Close to a solodized-
Solonetz.)

K-3055 November 7, 1962. New Zealand.
A little east of Alexandra. Profile
of lowburn loamy sand in the "leached
brown-gray earth with claypan."
(Typustall(?) Close to a solodized-
Solonch.)



K-3056 November 7, 1962. New Zealand. A little east of Alexandra. Landscape on site of Lowburn loamy sand.

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K-3055 November 7, 1982. New Zealand. A
little east of Alexandra. landscape on
side of lowdown loamy sand.

This soil could possibly be placed with our Non-Calciic Browns, and perhaps with Typustalfs in the new classification.

I note along the tracks near the site evidences of some old solodized-Solonetz. This is an old mixed up fan. The rainfall now is about 13 inches. The original grasses disappeared with the serious overgrazing. After the rabbits were destroyed, invading weeds and temporary grasses came in. They are now trying to get lucerne with the use of sulphur or sulphurized superphosphate. The trials show also the great soil variability. Lime here gives a little help in establishing lucerne, possibly due to a direct effect on the rhizobia.

They have some irrigation but the benefits are such that water spreading is confined to the lower smooth areas. The breaks of the fan are too cobbly and stony for tillage.

We then drive to Alexandra for another "official" photo and lunch. We leave for Ranfurly at 1:35 p.m.

As we go northeast I see some nice sheep pastures. Some are irrigated, a few with sprinklers. A little northwest of Umakau we pass beautiful pastures with border irrigation on the Linnburn soil. This seems to be an immature brown-grey earth with some solonetzic spots. The pastures are ryegrass, white clover, with some cocksfoot and some red clover. These pastures on Mr. Harvey's farm have about 5.4 Romney ewes to the acre. Mr. Leamy says that the solonetzic spots in these soils disappear



Alexandra, November 7, 1962

Back Row - Left to right:

O'Connor; Jensen; Johnson; Orbell; Stoneman; CEK; Viets; Saunder; Glentworth; Swaby; Thomas

Middle Row - Left to right:

Mrs. Viets; Penelope M. Grant; Mrs. Swaby

Front Row - Left to right:

Grobler; Williams; Loxton; Marechal; Tavernier; Schlichting; Leamy (and his children)

Dudal; Kearn

with irrigation. (K-3057).

We pass other farms with irrigation. Some pump water to the uplands and use contour races or runs.

The annual rainfall steadily increases as we go on to the northeast. We pass Becks at 2:50 and about 6 miles beyond stop to see the Cluden fine sandy loam - a southern yellow-grey earth. (K-3058; K-3059; K-3060).

The profile is in a dried out road cutting on the margin of the old dissected terrace.

- | | | |
|----------------|-----------|---|
| A ₁ | 0 - 9" | Nearly black (5Y 2/2) very fine sandy loam with mixed fine blocky and granular; many grass roots, moderate earthworm activity. |
| A ₃ | 9 - 17" | Olive brown (2.5Y 4.5/4) heavy fine sandy loam; firm; some dark filled wormholes. When dry the soil breaks out in irregular clods with more vertical than horizontal breakage. |
| B | 17 - 40" | Pale olive (5Y 6/4, dry; 2.5Y 4/4. moist) heavy fine sandy loam faintly mottled with grayer and browner shades. Soil is hard now and breaks irregularly into coarse blocky. I see some evidence of poor clay films and a few root channels. This comes close to being a fragipan but not quite. The lower boundary is unconforming. |
| D | 40 - 48+" | Lower material of coarse cobbles and gravels with some admixture of sand, silt, and clay. |

As we go on the weather looks bad. We cross Hills Creek and come out onto the Maniototo Plains. Here the fines are thin over the gravels. This area is transitional



K-3057 November 7, 1962. New Zealand. A little northwest of Omakau. Pasture on the Linnburn soil. Rye grass, white clover, and a bit of cocksfoot and red clover. Carries about 5-1/2 sheep to the acre.



2-11-2

X-3057 November 7, 1962. New Zealand. A little
northwest of Otago. Pasture on the lign-
burn soil. Rye grass, white clover, and a
bit of cocksfoot and red clover. Carries
about 2-1/2 sheep to the acre.



K-3058 November 7, 1962. New Zealand. Four or 5 miles northeast of Becks. Profile of Cluden fine sandy loam - southern yellow-grey earth.

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K-3058 November 7, 1962. New Zealand. Four
or 5 miles northeast of Becks. Profile
of Cluden fine sandy loam - southern
yellow-grey earth.



K-3059 November 7, 1962. New Zealand. Four or 5 miles northeast of Becks. Tavernier at site of Cluden profile.



K-3060 November 7, 1962. New Zealand. Four or 5 miles northeast of Becks. View of landscape on old dissected terrace.

K-3080

November 7, 1962. New Zealand. Four of
5 miles northeast of Becks. View of land-
scape on old dissected terrace.

K-3059

November 7, 1962. New Zealand. Four of
5 miles northeast of Becks. Tapering at
site of Cluden profile.

from the yellow-grey to the yellow-brown earths.

We come into Ranfurly and it starts to rain in earnest as we stop at the hotel at 5:00 p.m.

It is very cold here. After dinner and some chit chat in the common room I am early to bed.

November 8: It was very cold last evening. The morning seems relatively clear and sunny overhead but cloudy all around us.

The bus leaves at 8:38 on the long way to Timaru.

This country was made barren by rabbits until 10 years ago. Now they have good pastures with the use of sulphur, phosphorous, DDT, and selenium. Of these sulphur is of first importance. About 50 pounds of sulphur to the acre is normal and about $12\frac{1}{2}$ of phosphorous.

An insect that has grubs that eat the roots of the grass must be controlled with DDT. The insect *Porina* (?) takes the tops. These are indigenous. They live with the tussocks and invade any improved pasture. It is amazing what has been done here after destruction of the rabbits. First sliced carrots were spread by air; then after the rabbits got accustomed to eating them, poisoned slices were dropped.

After a little way it starts to rain and we get a little rain and snow together.

We stop about 19 miles southeast of Ranfurly to look at the Wehenga silt loam - a strongly leached yellow-brown earth that we would call a Sol Brun Acide with moderate fragipan - probably a *Fragochrept*. (K-3062). I take some pictures and get a good look at the tussocks. (K-3061; K-3063). Here good pastures have been developed by using

WEHENGGA SILT LOAM

The inspection site in the Pigroot is at the northern tip of the Wehenga soils which extend some 60 to 70 miles to the south-east and then to the south-west at altitudes ranging from 1200 to 2000 feet above sea level. The vegetation, snow tussock (*Danthonia flavescens*), hard tussock (*Festuca novae-zelandiae*) and low producing herbs, indicates the low productivity of these soils in their natural state.

Because of strongly acid reaction (pH normally 4.8 to 5.2) combined with extremely low calcium levels (normally 1 m.e.% or less) and deficiencies of phosphorus, sulphur and molybdenum, clovers are almost completely absent. Due to this absence of clovers nitrogen levels are too low to support high producing grasses and carrying capacity would be $\frac{1}{3}$ of a ewe equivalent per acre or less with breeding ewes, wethers and some cattle being run extensively.

IMPROVEMENT BY SURFACE TREATMENT:

There has been very little improvement of these soils by oversowing and top-dressing due mainly to the high cost of liming. Clovers have been introduced experimentally by surface sowing of lime pelleted inoculated seed with molybdenised reverted superphosphate but growth has been disappointing where less than 10 cwt per acre of lime has been applied.

DEVELOPMENT UNDER CULTIVATION:

The Wehenga soils are, however, of considerable agricultural importance because of their large area and great potential for development into high producing sown pastures. Relatively easy contour and good physical condition favour their development by cultivation with the growing of turnips and swedes in the development programme to provide winter feed for stock. Such feed crops are improved by long fallowing and liming at 1 ton per acre. 2 to 3 cwt per acre of molybdenised reverted superphosphate is sown per acre. Boron is necessary to avoid mottled heart and although nitrogenous fertilisers will increase yields they are seldom used.

Pasture mixtures of ryegrass (*Lolium spp*), cocksfoot (*Dactylis glomerata*) timothy (*Phleum pratense*), white clover (*Trifolium repens*) and Montgomery red clover (*Trifolium pratense*) may be sown alone or with rape for fattening feed. 2 to 3 cwt of molybdenised superphosphate per acre at sowing should be followed by regular top-dressing with superphosphate. DDT must be used at intervals to control the pasture pests, grass grub (*Costelytra zealandica*) and subterranean grass caterpillar (*Oxycaenus spp.*).

IMPORTANCE OF EARTHWORMS:

In newly developed pastures beneficial earthworms are not present and, although initially higher, production settles down to about 4000 lb dry matter per acre per annum or 2 to 3 ewe equivalents. Following ingress of suitable earthworms (usually *Allolobophora caliginosa*) production has been shown to increase by about 70% to around 7000 lb dry matter with a carrying capacity of 3 to 4 ewe equivalents. Heavier liming than the 1 ton per acre recommended may be necessary to gain maximum benefit from earthworm activity.

With full development, closer subdivision and provision of shelter, Wehenga soils are capable of semi-intensive sheep and cattle farming with fattening of surplus lambs and some cattle.

SAMPLES FROM HINDON EARTHWORM TRIAL AREA:

It may be difficult to believe that these soils can be developed to the extent that has been described and it may be equally difficult to understand the remarkable yield increase attributed to earthworm activity. For this reason the following material taken from the site of an earthworm introduction trial at Hindon, 4 1/2 miles to the SSE from here, is exhibited.

Turf Samples: Samples of pasture from:

1. Area without earthworms, showing poor vigour and production with dung and organic material accumulating on surface.
2. Area with earthworms, showing improved vigour and production brought about by earthworm activity and the absence of organic material on the surface.

Soil Profiles: (Prepared by Mr E.J.B. Cutler)

1. Without earthworms, showing build up of organic material at soil surface and clearly defined topsoil of relatively compact structure.
2. With earthworms, showing absence of organic material at soil surface, improved structure of topsoil and incorporation of topsoil and subsoil.

Washed Root Samples: (Prepared by Mr E.J.B. Cutler)

1. Without earthworms, showing organic accumulation at surface with much shallower and poorer root development.
2. With earthworms, showing absence of organic accumulation at the surface with deep well developed root system.

DETAILS OF EARTHWORM TRIAL

Full details of the above trial were given in the March 1959 issue of the N.Z. Journal of Agriculture. The following is a brief summary:

The trial field was ploughed from virgin snowgrass and fescue tussock in 1940, put through a rotation of fodder crops, and sown to pasture with kale in spring 1943. It received 3 tons of lime in the development period and has been regularly topdressed with superphosphate, and has periodically received molybdenum and DDT.

Earthworms (*Allolobophora caliginosa*) were introduced to pegged points in October 1949, and 4 years later in September 1953 circular green patches of earlier spring growth about 6 feet across were observed at each point of liberation.

On 18 May, 1954, areas 3 feet square were trimmed to even height and enclosed in wire netting frames, 5 where earthworms were active and 5 where there were no worms. Yields were recorded as follows:

Analysed Yield of Green Material: Total of Cuts at 22.9.54, 18.10.54 & 20.11.54

Without Earthworms	9,320 lb. per acre
With Earthworms (<i>A. caliginosa</i>)	16,090 " " "
*Difference	<u>6,770</u>

Standard error as percentage of plot yield = 19.7

*Significant difference: 5% = 3,640 1% = 5,290

The pasture, from which the exhibited samples were taken, is now 19 years old, and where earthworms are active, remains highly productive.

THE FACTS WHICH ESTABLISH THE CASE

It is the intention to believe that these facts can be developed to the extent that they can be developed and it is not at all difficult to understand the reasons for the facts which are stated in the following.

THE FACTS WHICH ESTABLISH THE CASE

1. The first fact is that the soil is not at all fertile and the production of crops is very low. This is due to the fact that the soil is not at all fertile and the production of crops is very low.

THE FACTS WHICH ESTABLISH THE CASE

2. The second fact is that the soil is not at all fertile and the production of crops is very low. This is due to the fact that the soil is not at all fertile and the production of crops is very low.

THE FACTS WHICH ESTABLISH THE CASE

3. The third fact is that the soil is not at all fertile and the production of crops is very low. This is due to the fact that the soil is not at all fertile and the production of crops is very low.

THE FACTS WHICH ESTABLISH THE CASE

4. The fourth fact is that the soil is not at all fertile and the production of crops is very low. This is due to the fact that the soil is not at all fertile and the production of crops is very low.

5. The fifth fact is that the soil is not at all fertile and the production of crops is very low. This is due to the fact that the soil is not at all fertile and the production of crops is very low.

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THE FACTS WHICH ESTABLISH THE CASE

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62/3033

Demonstration Trial - Plan

1962 International Soil Conference

C.J. Baynes
(Laid Down 28.2.62)
Waimate

Soil Type:

Waikahahi Silt Loam

Valley Road

5 yds
←

A	B	BC	C
C	BC	B	A

N

Treatments

11/2/64

A = 2 cwt superphosphate	} Per acre
B = 1 cwt double superphosphate	
C = Calcium sulphate 150 lbs	



K-3061 November 8, 1962. New Zealand. East of
Ranfurly. Snow tussock (*Danthonia
frigida*) on strongly leached upland
yellow-brown earth.

6. III

November 8, 1962. New Zealand. East of
 Rarangi. Snow tussock (Dactyloctenium
 aegyptium) on strongly leached upland
 yellow-brown earth.

K-3061



K-3062 November 8, 1962. New Zealand. East of Ranfurly. Profile of Wehenga silt loam - a strongly leached upland yellow-brown earth. (Sol Brun Acide with moderate fragipan or Fragocrept.)



K-3063 November 8, 1962. New Zealand. East of Ranfurly. View of mountain tussocks.

1111

K-3082

November 8, 1982. New Zealand. East of
Ranfurly. Profile of Wairua all loam
a strongly leached upland yellow-brown
earth. (Sol Brun Acide with moderate
fragipan or Fragipsect.)

K-3083

November 8, 1982. New Zealand. East of
Ranfurly. View of mountain cuscoks.

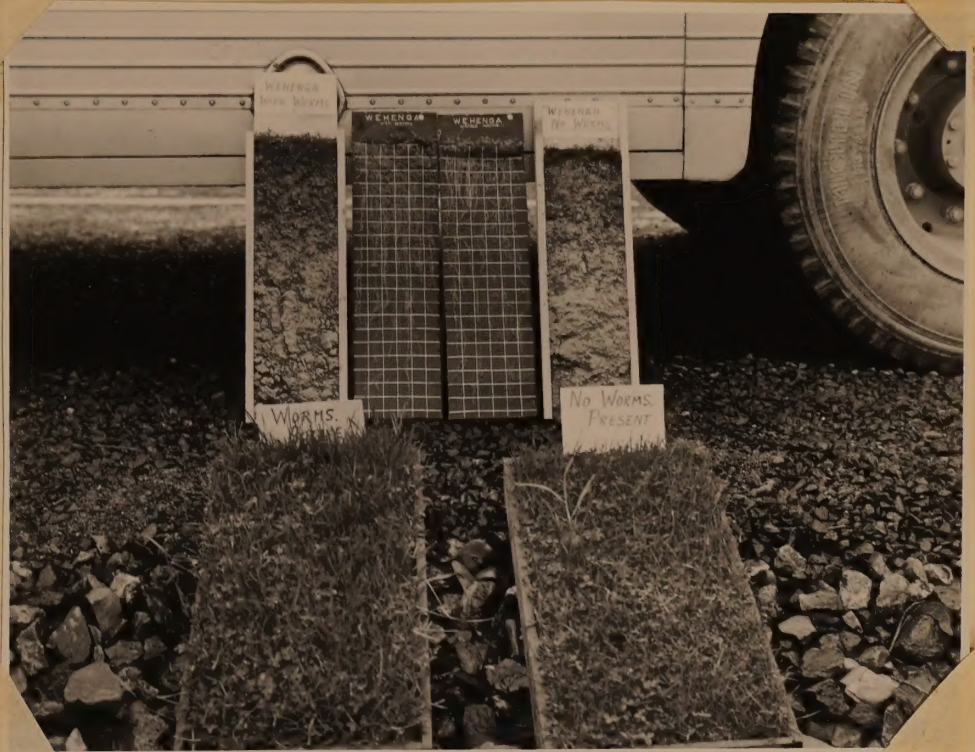
sulphur, phosphorous, lime, and boron.

On some of these soils the introduction of earthworms has increased pasture yields by 70 percent. Without them a small peaty mat of high C/N ratio forms at the surface. The worms work this deeply into the surface soil. We are shown an exhibit of monoliths and root diagrams that show these differences. Apparently also the earthworms move the lime into the lower soil. (K-3064). Here also DDT is necessary. It must be applied to the pasture early to avoid DDT in the meat. Most of the hill pastures require molybdenum for clover.

We pass on to soils influenced by basaltic materials. These respond better to aerial top dressing.

The rain comes and goes, but it is cold. We pass Green Valley at 10:20 toward Palmerston. I am very much impressed here with what the New Zealanders have done through research and cooperation with farmers and stockmen to improve these hill pastures with aerial fertilization and seeding. It is really remarkable.

They have no trouble with their clover provided it is inoculated when necessary. The grass seeding does not work quite so well yet. The clover seed is first covered with methol cellulose, then the inoculants are added from peat cultures. Finally the seeds are coated with lime. This is done with a cement mixer. After drying the seeds can be stored several weeks. Once the clover is dominant



K-3064 November 8, 1962. East of Ranfurly. Demonstration to show differences in rooting and plant growth relating to the presence or absence of earthworms. Note the deeper A₁ horizon, deeper rooting and better vegetation on the left.

K-3064 November 8, 1962, East of Raminity.
 Demonstration to show differences
 in rooting and plant growth relating
 to the presence or absence of earth-
 worms. Note the deeper A horizon,
 deeper rooting and better vegetation
 on the left.

one can oversow with grass wherever one can go with a tractor. In the hills, the pasture is overgrazed and then sown with a plane. Now after establishment farmers top-dress every four years but oftener would be better. We stop for pictures of the improved pastures and farm forestry, mostly P. radiata in the Shag Valley a bit west of Dunback. (K-3065).

We also look at the adjacent hill pastures on steep land with soil between yellow-brown and yellow-grey earth.

We drive along over yellow-grey earth, moderately leached, said to have a claypan. This is probably closer to a fragipan. The parent material is loess over schist. We take a brief look at this and then go on past Dunback. (K-3066). The valley broadens and the upland slopes are easier. Some farms with 160 to 200 acres carry 3.5 to 4.0 breeding ewes per acre plus a little wheat and a few beef cattle.

We stop briefly in Palmerston and our attention is drawn to a monument, on a high hill, to McKenzie who was responsible for splitting large holdings for closer settlement through several land laws passed by Parliament, including the graduated land tax of the 1890s.

Near the sea we pass yellow-grey earths modified by cyclic salt - "saluviated" in the New Zealand patois.

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K-3065 November 8, 1962. A little west of Dunback. Shag Valley. Note improved pastures and farm forestry (mostly P. radiata).



K3066 November 8, 1962. A little west of Dunback. Hill pastures on steep soil between yellow-brown earth and yellow-grey earth.

XIV

X-3065 November 8, 1962. A little west of Dumbuck.
Shad Valley. Note improved pastures and farm
forestry (mostly P. radiata).

X-3066 November 8, 1962. A little west of Dumbuck.
Hill pastures on steep soil between yellow-
brown earth and yellow-grey earth.

We pass Hampden at 11:45. We have rain again. Originally the hedges here were sod. The tops of these were planted with gorse, hawthorne, and the like. Where well trimmed they look nice; otherwise they spread badly. Many use machines to keep them trimmed.

We go on through beautiful rolling farm country, most of it sheep pasture. We pass Maheno and take a quick look at the Waiareka clay loam, a very weakly leached brown loam. The surface is nearly black clay loam with mixed granular and angular blocky. (See guide notes, page 17.1). It is too rainy for pictures and time is too short for descriptions. Probably this soil intergrades to the vertisols. The soil supports excellent sheep pastures.

There is quite a bit of lucerne here for pasture, hay, and silage. We see wheat, swedes, market gardens, and poultry, but mainly sheep on pastures.

We stop in Oamaru for lunch and leave about 2:00 p.m. We go northeast along the coast toward Timaru across the lower end of the great valley of the Waitaka. Along the road we pass a marker for the 45th parallel - half way between the Pole and the Equator. Most farms have shelter-belts, mainly P. radiata.

Just south of the Waitaka River we stop to look at the Steward stony sandy loam. This looks like an old friend, a cultivated Podzol or Brown Podzolic, fertilized

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Just south of the Waitaka River we stop to look at the Steward stony sandy loam. This looks like an old island, a cultivated Podzol or Brown Podzol, fertilized

and treated to get a thickened A_1 . The surface is gently undulating and the parent materials are gravels and cobbles from the old stream beds.

A_{1p}	0 - 2"	Very dark brown (10YR 2/2) gravelly sandy loam with soft crumb.
A_3	2 - 10"	Brown (10YR 4/3) very gravelly sandy loam.
B_1	10 - 15"	Transitional.
B_2	15 - 31"	Dark reddish brown (5YR 3/4). The soil seems somewhat compacted but is primarily the old B of the Podzol somewhere between orterde and ortstein.
C	31+"	Yellowish brown coarse gravel, sand, and cobbles.

This profile is near the edge of the stream terrace. The plowed field has small cobbles in the surface. A little lime is used. The soil responds to sulphur but enough is contained in the ordinary superphosphate.

We cross the Waitaka and enter the Canterbury Plain. It rains some more.

We look at the Waikakahi silt loam, a pedocalcic soil associated with yellow-grey earths. (K-3067).

A_1	0 - 7"	Very dark grayish brown (10YR 3/2) light silt loam; fine to moderate granular structure; many grass roots.
A_{31}	7 - 16"	Dark yellowish brown (10YR 4/4) light silt loam; mixed granular and soft small blocky; many roots; highly friable.
A_{32}	16 - 23"	Olive brown (2.5Y 4/4) very fine sandy loam; very slightly firm.
C_{ca}	23 - 34"	Olive brown (2.5Y 4/4) fine sandy loam with some whitish streaks and specks; compact but digs out easily and is friable.
C	34+"	Olive (5Y 5/3) compact fine sandy loam.



K-3067 November 8, 1962. 40 miles north of Oamaru.
Landscape of Waikakahi silt loam. (Rain).



K-3068 November 8, 1962. 4 miles south of Timaru.
Demonstration on Timaru silt loam. Soils
show little response to superphosphate here.
(Colin McLeod).

XIV

November 8, 1982. 40 miles north of Oamaru.
Landscape of Waikakahi silt loam. (Rain).

November 8, 1982. 4 miles south of Timaru.
Demonstration on Timaru silt loam. Soils
show little response to superphosphate here.
(Colin McLeod).

K-3088

This soil reminds one of a youngish Marshall in the United States. Horizon boundaries below A_2 are wavy. In the lower part is some discontinuous brown banding which suggests an old surface. In the new system this may be an Ustoll with high base saturation. This soil responds to superphosphate and gypsum. The animals graze most where the fertilizer response is good. Some contour their pastures but with good fertilization this is not good economic practice.

As we leave a reporter sits by me. We cross the Pareora River at 4:20. It now rains fairly hard just as we are supposed to see the Timaru silt loam. We do stop to look at experimental plots. On the soil they use about one ton of lime every six years. One cwt. of superphosphate every three years is said to be enough for pasture. Autumn-sown cereal requires no fertilizer. Spring-sown cereal responds to about one cwt. of superphosphate. Both phosphorous and a bit of boron are needed on swedes and cabbage. Besides wheat and swedes they grow some linseed and barley here.

We go out and look at the wet plots where wheat and other spring-sown cereals show no response to 1, 2, or 3 cwt. of superphosphate broadcast. (K-3068).

Back in the barn we have a dispute here about soil tests versus field trials as a basis for recommendations. I emphasize that such arguments are useless. We must develop systems for agricultural improvement involving soil surveys, permanent plots, chemical soil tests, and vegetation tests, all backed by research and with full consideration to the physical conditions of the soil and the genetic potential of the plants. In any local area we work out the combination of these that meets the problem.

We go on to Timaru and reach the Grosvenor Hotel at 5:50. After dinner we go to the Bay View Tea Room as guests of the local City Council and the Farmers' Union. We are addressed by a local agricultural leader on the agriculture of South Canterbury. This is followed by a slide lecture, several pretty speeches, singing, and the like. And then supper. I leave a bit early and get to bed a little after 11:00 p.m.

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November 9: I am up at 6:10, pack, take my bags down and then have bed tea. From my window it looks like a clear sunny morning but cold.

The bus leaves at 8:30 and we drive back to see the Timaru silt loam, a moderately leached yellow-grey earth. (K-3069; K-3070). The site is neither good nor well prepared.

- | | | |
|----------------|----------|---|
| A ₁ | 0 - 8" | Very dark brown (10YR 2/2) silt loam; mixed weakly developed fine blocky and granular; friable; much worm activity. |
| A ₃ | 8 - 15" | Yellowish brown (10YR 5/6) silt loam; weakly developed small blocky; friable. The soil is streaked with many grayish brown worm casts. |
| B | 15 - 23" | Light yellowish brown (10YR 6/4) heavy silt loam, mottled with yellowish brown (10YR 5/6) and yellowish red (5YR 4/6); firm in place; digs out in irregular clods that crumble into poor irregular medium blocky; fairly friable. (Seems to be a degraded horizon.) |
| Frag. | 23 - 48" | Light yellowish brown (10YR 6/4) silt loam; massive; hard in place; digs out in friable irregular clods. In place the soil has an irregular polygonal pattern with gray and strong brown streaks that are mainly vertical. In the cut the so-called New Zealand gammate structure is evident. |
| C | 48+" | This material is like the above but less firm and less streaked silty loess. |

The surface is slightly undulating and about 2 percent slope at the site.

In the new classification this might work out as a Fraglossudalf.

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A₂ 8 - 15" Yellowish brown (10YR 5/6) silt loam; weakly
developed small blocky; friable. The soil is
streaked with many grayish brown worm casts.

B 15 - 22" Light yellowish brown (10YR 6/4) heavy silt
loam, mottled with yellowish brown (10YR 5/6)
and yellowish red (5YR 4/6); firm in places;
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Frageosudalf.

N.Z. Could Capture Japanese Market For Quality Beef

New Zealand need not take Britain's proposed entry to the European Economic Community too seriously. Markets with Japan were opening. For example, the people in Japan were rapidly developing a taste for good quality beef and if New Zealand reduced its dairy cattle and increased beef herds Japan is one market that could be captured. These views were expressed yesterday by Dr C. E. Kellogg, who is assistant administrator for soil survey in the United States Department of Agriculture.

Dr Kellogg was in Timaru last night with a party of leading world soil scientists who will attend the international soil conference at Massey College, Palmerston North, later this month.

"If Britain joins the E.E.C. New Zealand's dairy farming exports to U.K. will possibly be reduced greatly," said Dr Kellogg.

Commenting on education in New Zealand, Dr Kellogg said that more emphasis should be placed on higher academic training. He was amazed particularly by the number of young girls in New Zealand who do not seek a higher education. "A greater emphasis is being placed on education in the States," he said, "because we are progressing in an age where skilled personnel are vital."

Discussing soil survey and conservation work in America, Dr

Kellogg said that nearly all rural areas were divided into districts on a unit basis. "Technical assistance on soil development and water conservation is then available through the Department of Agriculture in each district.

"Results of soil surveys are also available to farmers who are assisted in developing their land, by adopting a better arrangement of fields and the technical use of fertilisers.

"By law land owners are permitted to do as they wish with their land. Naturally owners want to get the best possible yield. However, the country generally has to take a long-term view and guard farm land so as it will always be beneficial. Therefore government farming administration is aimed at meshing these two attitudes," said Dr Kellogg.

The TIMARU Herald 9 Nov. 1962



K-3069 November 9, 1962. $2\frac{1}{2}$ miles north of Timaru. Profile of Timaru silt loam - a moderately leached yellow-grey earth (or Fraglossudalf). Note deep, filled cracks.

K-3069 November 9, 1962. 2 1/2 miles north
of Tamaru. Profile of Tamaru silt
loam - a moderately leached yellow-
grey earth (or Fraglosudalit). Note
deep, filled cracks.

K-3069
#6



K-3070 November 9, 1962. $2\frac{1}{2}$ miles south of Timaru.
Landscape on Timaru silt loam.



K-3071 November 9, 1962. 11 miles north of Ashburton.
Party at site of Lismore profile. On the bank
r. to l. O'Connor, Leamy, ----; in the pit
Tavernier, Schlichting, -----; Marechal,
Johnson, Glentworth.

XIVII

K-3070 November 9, 1962. 2 1/2 miles south of Timaru.
Landscape on Timaru silt loam.

K-3071 November 9, 1962. 1 1/2 miles north of Ashburton.
Party at site of Lismore profile. On the bank
r. to L. O'Connor, Leamy, ---; in the pit
Tavernier, Schlichting, ----; Macdonald,
Johnson, Glentworth.

The fertilizer practices were discussed last night. Many years ago these soils were used for almost continuous wheat under which they lost both fertility and structure. After 17 years of improved pasture both are restored.

We return to the hotel, pick up the ladies, and get petrol. We leave Timaru at 10:12. We see a bit more wheat but mostly sheep pasture. Some grass is being cut for hay without proper curing. Here the plain is nearly level and includes some ill drained soil. I see some vegetables. Many of the field boundaries have low trimmed hedges in addition to wire fences.

It is said that the soil here was probably covered with forest that was destroyed by the Mauris. Then the tussock grasses came.

We cross the Opihi River and pass Temuka. Here too a general system of wheat culture was replaced with the grass-clover pasture along with fertilization with P, S, and some secondary nutrients. At first the transition was made with short leys; then came the present long leys with the improved ryegrass. Now the chief products are wool and fat lambs, along with some wheat, swedes, and small seeds. Our guides call this a flexible and stable farm economy.

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We cross the Orari River. The soils seem a bit drier. They are shallower over gravel and are similar to the Steward soils seen earlier. They are said to be classified with the Lismore series that are a bit more moist than the Steward.

We cross the Rangitata River about 10:43.

Near these big rivers the soils are thin over sand, gravel, and cobbles. The small streams between have brought finer earth from the foothills. Along them the soils are deeper and better; but some of them need drainage.

Now again we are on the Lismore soils. We pass Hinds at 10:53 and cross the Hinds River where the soils are deeper over gravels.

It is said that the water table in the Canterbury Plain is fed by the rain on the plains and the foothills. The mountain water nearly all passes out in the gorges. Thus the ground water table is much deeper in the central plain than in the foothills or in the coastal plain and water for domestic and stock use is a serious problem in the central plain. Farm wells are 200 feet deep or more. Thus much planning work is being done now to bring water to this area in races for irrigation and other use.

We pass through Ashburton about 11:15. We see quite a few nice windbreaks and broader shelterbelts of conifers. Besides improved pastures farms here have potatoes, grass seed, and white clover seed. We are now on the Lismore soil, which is quite shallow over gravel. The most improved pastures go up to 3 or 4 ewes per acre without irrigation and up to 5 or even 6 with irrigation. Farmers here use an initial application of about 2 tons of lime followed by one ton every 8 years. They use an annual top dressing of about $1\frac{1}{2}$ cwt. of superphosphate and some sulphur in addition.

We pass some sheep paddocks with border irrigation. The pastures are more lush than normal because of the above-normal rainfall this year. We are given the following crop yields: Wheat averages about 50 bushels per acre; linseed about 10 cwt. without irrigation; barley about 50 bushels per acre but some have had 100; and potatoes 6 to 7 tons although few have had 20 tons.

I am not sure whether it is because of the races or not but there is a holiday in this Christchurch area and few people are working.

We stop at the Winchmore Irrigation Station and Mr. Walker, the Assistant Director speaks to us. They have 750 acres for border irrigation. This station is run by the Advisory Section of the Department of

Agriculture to assist farmers on the Canterbury Plain. Ninety percent of the irrigated soil has pasture. They have many sheep here in the experimental work and their testing heavily involves animals. There is no pumping; water is taken from the river by gravity flow. They have no water storage. Because of the gravels (shingle) neither waterlogging nor alkalinity nor excess salts are problems.

Animals grazed on the yellow-grey earth soils, especially the more shallow and stony ^{a/}(cobbly) ones, have shown selenium deficiency. With selenium they get a five-pound increase in lamb weight up to the weaning and another 5 pounds in the following 12 weeks. They have not found the white muscle disease yet in places the lambs die without selenium. Also selenium deficiency leads to a low lamb crop. The effect seems to be on the ewes rather than the rams. Selenium-treated animals have about 5 percent more wool clip. Selenium deficiency is worse in seasons of lush growth. The effects of selenium deficiency are worsened with a build up of internal worm parasites. To correct it they use 1 to 5 mgs. of selenium as sodium selenite about 1 month before breeding and again before lambing. Lambs are treated before weaning and at docking time. Then if they bring the sheep together for any other purpose they dose them with selenium. About $\frac{1}{2}$ of the

^{a/} Commonly the New Zealanders use "stony soil" or "stony loam" for what we call "cobbly soil" or "cobbly loam."

selenium given the animals is excreted. They avoid the direct use of selenium on pasture soils for fear of contamination.

They tell me that many farmers have 1 ram for 40 ewes but they think 1 to 80 is better.

We look briefly at the Lismore silt loam on a very gently undulating fan. (K-3071; K-3074). It has a gravelly dark brown surface over stratified gravels. There is an irregular reddish brown B at 12-20 inches (see tour notes). This soil is said to be on the margin of the yellow-grey earth and close to yellow-brown earth. This is the dominant soil for a wide area. The base consists of alluvial gravels covered, or being covered, by loess from the braided streams. Bill thinks the soil would fall in the new system as Umbrept-Ochrept.

We go down to see some canvas gadgets used for border irrigation. They use a canvas sheet on a small frame to guide the water out of the canal and into the borders. They have developed an automatic system with chains and clockwork to trip the canvas by one outlet and let the water flow to the next. Then they are experimenting with a reverse scheme by starting downstream and have the sheets drop instead of release. This is a safer system if something goes wrong. (K-3072; K-3073).



K-3072 November 9, 1962. 11 miles north of Ashburton (Winchmore Irrigation Research Station). View of automatic tripping of canvas irrigation diversion device, just before release.



K-3073 November 9, 1962. 11 miles north of Ashburton. (Winchmore Irrigation Research Station). The clockwork device lowers the canvas for diverting irrigation water.

XIV

K-3072

K-3072 November 9, 1962. 11 miles north of Ashburnton
(Winchmore Irrigation Research Station). View
of automatic tripping of canvas irrigation
diversion device, just before release.

Fig 2

K-3073

K-3073 November 9, 1962. 11 miles north of Ashburnton.
(Winchmore Irrigation Research Station). The
clockwork device lowers the canvas for diverting
irrigation water.



K-3074 November 9, 1962. 11 miles north of Ashburton. (Winchmore Irrigation Research Station). Landscape on Lismore soil. Experimental paddocks in foreground.

3A

11-10-52

K-3074 November 9, 1952. 11 miles north of
Ashburnton. (Winchmore Irrigation Research
Station). Landscape on diamore soil. Experi-
mental paddocks in foreground.

November 9, 1952. 11 miles north of
Ashburnton. (Winchmore Irrigation Research
Station). Landscape on diamore soil. Experi-
mental paddocks in foreground.

Then at the Station headquarters we have a box lunch from the hotel with tea and coffee and some more lectures.

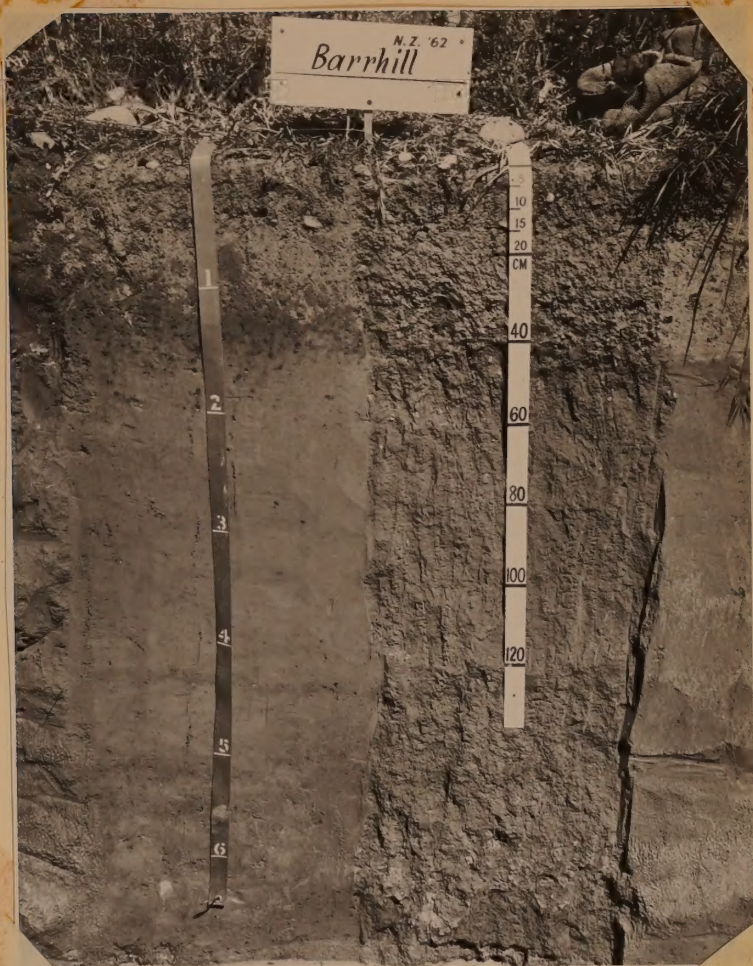
In quite a few years they have 50 days or so with soil moisture at or below the wilting coefficient. This cuts yields by one-half. Some irrigate as much as nine times, but for maximum return 4 or 5 are recommended. They want to have about 2.4 inches of available water in the upper 12 inches of soil. The contract price is 4/s per acre foot. The farmer must take $\frac{1}{2}$ acre foot for his whole acreage whether he uses it or not. If he simply takes what he wants without a contract, the price is 8/s per acre foot. Probably these prices will be increased.

We leave the Station at 1:40 p.m. and look at the Barrhill fine sandy loam, a Regosol with a good A. I look at the profile hastily. (See tour guide). (K-3075).

A ₁	0 - 9"	Dark grayish brown silt loam.
A ₃	9 - 21"	Mottled dark reddish brown (2.5YR 3/4) and very dark grayish brown (10YR 3/2) silt loam.
C _g	21 - 45"	Finely mottled olive brown fine sandy loam.
C	45+"	Pale olive brown fine sandy loam (?).

This probably falls in the Umbrept group.

I try for some pictures here of the nice sheep pastures near Barrhill and also of the highly braided Rakaia River. (K-3076).



K-3075 November 9, 1962. About 24 miles north of Ashburton. Profile Barrhill fine sandy loam. A Regosol with a good A (an Umbrept).

K-8075 November 9, 1962. About 24 miles
north of Ashburn. Profile
Barthill fine sandy loam. A
Regosol with a good A (an Umbrist).

We look at some tests with wheat on this soil having serious manganese deficiency which is cured by spraying 12 pounds of manganous sulphate per acre. The deficiency shows up in small irregular patches over the field.

We then drive on to the west for a quick look at the upper Rakaia Valley near the gorge. (All day I have been having trouble with the sole of my left boot. I tie it up with string but it keeps coming off.) As we cross the valley near the foothills we come down a whole series of terraces, perhaps 12 to 16 of them. We are told that this was the first place in the Canterbury area where sulphur was used to improve pastures.

We pick up a representative of the Selwyn Plantation Board, which deals with forestry in this area. Rural people here need shelter against the strong winds coming out of the mountains, especially those that come through the gorge of the Rakaia River. In addition farmers have been developing their own individual windbreaks. Forest trees are subject to several major hazards here: Strong gales, drought, snow, hail, and unseasonable frost. When gales come after the soil is wet many of the trees go over.

The Douglas fir is the most nearly resistant to heavy gales of those tried. P radiata is used mostly by farmers in strips. For block plantings they are placed 8 feet by 8 feet. Some of the cedars are also useful.



K-3076 November 9, 1962. About 24 miles north of Ashburton. Looking down the bed of the Rakaia River - a typical braided stream.



K-3077 November 9, 1962. Near Coalgate. View in Douglas fir forest planted in 1925 after recent thinning.

K-3076 November 9, 1962. About 24 miles north of
Ashburton. Looking down the bed of the
Rakata River - a typical braided stream.

K-3077 November 9, 1962. Near Coalgate. View in
Douglas fir forest planted in 1925 after
recent thinning.

I am told that during the heavy gales the trees behind the front go before the first ones to be hit by the wind.

We pass Horarata at 4:00 p.m.

Many farmers lop the conifers from the top in order to reduce windthrow. This should be done before the trees are too old if they are to continue to grow well. Such lopped conifers are unsightly to me. I explained to them that the Soviets, the Canadians, and the Americans have learned recently that for the welfare of the trees and for the protection of crops one should leave an air space of about 2 feet between the ground and the lowest branches, which lets some of the air through and reduces the turbulence and "suction effect." They had never heard of this and I think this is their trouble. I think that the wind hits that front solid wall of trees and that the turbulence destroys the ones back of them.

We stop at Watson's Plantation and see a nice planting of Douglas fir made in 1925. The stand has just been thinned. The trees are 80 to 85 feet high and are about 10 to 12 inches dbh. (K-3077).

We pass Coalgate. In the hills farmers get subsidies for forest plantings in critical areas.

We pass a stand of Ponderosa pine badly hurt by hail.

We reach Liguia Village at 7:00 and have to change. We hurry to dinner. There is a very plain house here, with a small porch. I am going to bed.

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We pass Coalgate. In the hills farmers get subsidies for forest plantings in critical areas. We pass a stand of *Ponderosa* pine badly hurt by hail.

I am told that opossum was introduced. What a pity! They have few natural enemies here and are becoming a nuisance to forestry. (Added later: A few days later the press reported a Parliamentary debate on what to do with the varmints.)

They now recommend here a front planting of P. radiata and a lea planting of Himalyan Cedar. (Cedrus deodara).

We stop for tea with Mr. and Mrs. Deans of an old early settler family that took up land in the right place and sold it at the right time. They obviously have plenty of money. Mr. Deans devotes a great deal of his effort to the promotion of forestry as did his forebearers. They have a lovely home and a beautiful garden with many sorts of trees and flowering shrubs, especially rhododenrons and azaleas. These fine hosts serve us tea and cake.

Then we and the Deans go on to the headquarters of the Selwyn Plantation Board at Darfield. Here we are regaled with stronger drinks and with pleasant conversation. We leave at 6:20 for Lincoln.

We continue to drive over a nearly level plain. Most of the soils are well drained and have well developed farms. There are a great many sheep along with some cereal and potatoes. I see the odd poultry farm.

We reach Lincoln College at 7:00 and have no time to change. We hurry to dinner. These are very plain student rooms, cold indeed tonight. I am early to bed.

November 10: This turns out to be a very noisy place with extremely misbehaved young students in temporary residence. Several of them start getting up around 5:30, which is quite all right, but they run down the halls, shout to one another, and slam doors. Out of my window it seems clear and sunny. I am the first downstairs and see the supervisor of these young men. I ask him whether they are trying to train gangsters or what. He tells me that these are correspondence-school students from isolated farms and sheep stations. The parents, especially the mothers, supervise their lessons and then every other year they bring the boys together and on alternate years the girls. He says that they have no playmates and when they get together they maybe are too lively. I tell him, "No, just badly mannered - about the worst I have ever seen in any country." "Well," he says, "You may be right. I'll have a go with them about it today." But I am sure he is too soft for the job to be done. I pity him for the next month.

I walk about the grounds a bit. The college has some nice gardens - especially roses. Here, as elsewhere in New Zealand, most of the garden plants have been introduced from the United Kingdom. I find a piece of stout string and try tying up my boot again.

We have breakfast and are then ready to leave at 8:50. There is a delay and I step into the library, which is not very good.

Then we go out to the dairy farm where most of the lecturing is done by the Head of the Dairy Department. The soil here is Timuka silt loam drained with tile at about 130 feet and with moles to supplement the tile. (K-3078). They use 2 cwt. of superphosphate without irrigation and about 4 cwt. on irrigated upland soils. They have about 5 months of winter - not very severe but frosty - and some weeks of summer drought.

On this college dairy farm, which is run as a separate enterprise, they have Holstein Friesian cows for whole milk sold in Canterbury. They say the production is about 1,000 gallons per cow with 4.3 percent butterfat.

Here the herd is on a mixed pasture with ryegrass, timothy, cocksfoot, white clover, and some red clover. The professor tells us that they get 100,000 gallons of milk on 100 acres with a net profit of 3,500 pounds. But income from dairying is best for those supplying town milk.

This soil is said to be difficult to work into a good seedbed. The soils better drained than this will stay down in good pasture for 20 years if irrigated.

I have never seen a professor who strutted more than this fellow. He is an example of the kind of professor who spends so much time with immature minds



K-3078 November 10, 1962. New Zealand.
Lincoln College. Dairy herd on
pasture of ryegrass, cocksfoot,
timothy, white clover, and some
red clover established on Temuka
silt loam, drained.

K-3078 November 10, 1952. New Zealand.
Lincoln College. Dairy herd on
pasture of ryegrass, cocksfoot,
timothy, white clover, and some
red clover established on Tanika
silt loam, drained.

that he doesn't know how to deal with ordinary folks. He belittles his colleagues, makes silly jokes, and is often wrong but never in doubt. The cows are "girls" in his jargon.

I look briefly at the Timuka silt loam and get pictures. (See guide notes) (K-3079). The somewhat peaty material beneath gives some suggestion of old cat clay. Generally I should say that this is a typical clayey Wiesenboden. The water table is now about 30 inches and is near the surface in winter. This kind of soil occurs on the nearly level toes of the fan. In the new classification this may be a Haplaquoll roughly between Entic and Orthic.

Then we have a field lecture by the Head of the Advisory Service of Lincoln College. Apparently the Advisory Service gives at least some advice to all that come but farmers can pay for a complete management service, in the sense of a complete farm plan with follow through. The fees depend on the work and travel to be involved. The speaker says he has 30 farms under his supervision and also a 400-acre mixed farm unit at the College. Here the general scheme is pasture for 4 years; potatoes or peas; two crops of wheat; and then barley. After the barley they seed part of the fields for small seeds for sale of grass and clover. Of the income a little over $\frac{1}{3}$ is from crops, a little over $\frac{1}{2}$ from small seeds, and a bit under $\frac{1}{3}$ from the sheep. The wheat here averages 60 bushels per acre, but under the most favorable conditions they have

that he doesn't know how to deal with ordinary folks. He belittles his colleagues, makes silly jokes, and is often wrong but never in doubt. The cows are "girls" in his jargon.

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K-3079 November 10, 1962. New Zealand.
Lincoln College Farm. Profile
Temuka silt loam (Haplaquoll,
between Entic and Orthic).

8A

November 10, 1982. New Zealand.
Lincoln College Farm. Pteris
Tenuis sili form (Haplophylla
between Entic and Ophio).

had 100 bushels.

We are back to the College for lunch, return to the buses and go southeast to see the Taitapu silt loam - a rather recent gley soil. (K-3080).

- | | | |
|--------|-------------------------|---|
| A
P | 0 - 11 [±] 3" | Nearly black silt loam finely mottled with dark reddish-brown; easily friable fine angular blocky; many grass roots; some worms; sharp wavy lower boundary. |
| G | 11 - 27" | Gray (5Y 5/1) silt loam weakly mottled with olive (5Y 5/4); massive but easily friable; faint vertical cracks; sharp wavy lower boundary. |
| O | 27 - 44 [±] 6" | Brown, partially decomposed peat. |
| D | 44+ | Bluish, massive silty clay with streaks of reddish-brown. |

This soil occurs in a smooth, very slight depression. The peat is thought to be 2,400 years old. There is charcoal in the peat and in the surface soil. The old root channels of trees are clearly evident. I suspect that the peat was covered with silty alluvium and a Half-Bog developed. With fertilization and plowing this has become a Wiesenboden. In the new system I suppose it would be an Ochraquept approaching an Umbraquept.

Trials with fertilizer here show a large effect of phosphorous. (K-3081).

For some reason there is a great deal of discussion about this relatively simple soil.



K-3080 November 10, 1962. New Zealand.
Near Lincoln College. Profile
of Taitapu silt loam - an old
Half-Bog changed into Wiesen-
boden.

my

1/2

K-3080 November 10, 1962. New Zealand.
Near Lincoln College. Profile
of Tatapu silt loam - an old
Half-Bog changed into Wiesen-
boden.



K-3081 November 10, 1962. New Zealand.
Near Lincoln College. Trails on
Taitapu silt loam show a big effect of
phosphatic fertilizer.



K-3081 November 10, 1962. New Zealand.
Near Lincoln College. Treated on
Tatapani soil show a big effect of
phosphatic fertilizer.

We go on Templeton silt loam - a yellow-grey earth on gently undulating well drained upland. Actually it looks a little more like the New Zealand yellow-brown earth. We should call it a Sol Brun Acide with fragipan or, in the new system, a Fragochrept. (K-3082).

- | | | |
|----------------|----------|--|
| A _p | 0 - 9" | Very dark grayish-brown (10YR 3/2) silt loam; friable; medium to fine blocky; many grass roots; considerable worm action. |
| A ₃ | 9 - 17" | Dark yellowish-brown (10YR 4/4) silt loam with dark worm channels. The soil digs out in easily friable clods with weakly developed blocky structure. |
| B (Frag.) | 17 - 27" | Dark olive brown (2.5Y 3/4) coarse silt loam; massive; moderately developed fragipan that digs out in difficultly friable clods; numerous fine pores; faint mottling of lighter and darker shades; weak stone line at the top. |
| C | 27 - 36" | Olive (2.5Y 4.5/4) heavy sandy loam; massive; friable. |
| D | 36+" | Grayish gravels. |

The trials here show good response to lime and also to phosphorous if lime is added. There is no response to sulphur and little or none to molybdenum.

We then go northwest to look at the Selwyn sandy loam - a recent gently undulating sandy soil over gravel (K-3083). In the new classification this would be an

1962. International Soil Conference

Papua New Guinea

Soil Type:

Templeton Silt Loam

Treatments

A. Control

B. Calcium

C. Monoculture

1. Sodium phosphate at 25 tons

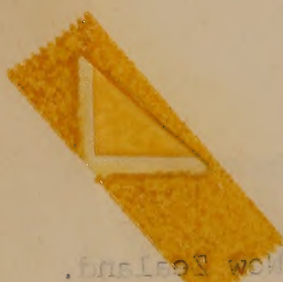
2. Ground limestone at 5 tons

K-3082 November 10, 1962. New Zealand.

Replication B Same treatments About 10 miles northeast of

4.2 yds x 2.

Lincoln College. Profile
Templeton silt loam - Sol Brun
Acide with fragipan (or Frago-
chrept).The two replicates were sprayed
and White Clover, Montgomery
oversown on 29.9.61



November 10, 1982. New Zealand.
About 10 miles northeast of
Lincoln College. Profile
Templeton site from - Sol Brun
Acids with trapigan (or Frago-
chrept).

X-3982

Demonstration Trial - Plan1962 International Soil Conference

Paparua County Council

Broadfields.

(Laid Down 30.10.61)

Soil Type:Templeton Silt Loam

	A	B	C	B+C
1.				
2.				
1+2				

Treatments

- | | | |
|----|---|------------|
| A. | Control | } per acre |
| B. | Calcium Sulphate at $1\frac{1}{2}$ cwt | |
| C. | Monocalcium phosphate at $1\frac{1}{8}$ cwt
equivalent to 3 cwt superphosphate | |
| 1. | Sodium Molybdate at $2\frac{1}{2}$ ozs | |
| 2. | Ground limestone at 2 tons | |

Replication B Same treatments but plot size
4.2 yds x 2.6 yds.

The two replicates were sprayed with Paraquat,
and White Clover, Montgomery Red Clover were
oversown on 29.9.61



K-3083 November 10, 1962. New Zealand.
About 18 miles north of Lincoln
College. Profile of Selwyn sandy
loam (Entic Haplustoll).

K-3683 November 10, 1982. New Zealand.
About 18 miles north of Lincoln
College. Profile of Selwyn sandy
loam (Entic Haplustoll).

SELWYN SANDY LOAM

9.1

Weakly leached southern recent soil from alluvium.
(Weakly enleached luvic soil)

Regosolic

SLOPE AND ASPECT Flattish terrace

VEGETATION OF SITE Brown top (Agrostis tenuis) and subterranean clover
 (Trifolium subterraneum).

NATIVE VEGETATION Lowland short tussock grassland; scattered kowhai
 (Sophora microphylla) and matagouri(Diocaria toumatou)

PARENT MATERIAL Greywacke alluvium, sands and silts over stones.

RAINFALL 640 mm (25 in.)

TEMPERATURE Mean. Jan. (summer) 16°C (61°F) Mean July (winter) 5°C (41°F)

ALTITUDE 68 m 230 ft

LOCATION Howell's farm, 4 ml. W.N.W. from Yaldhurst; corner paddock
 next to intersection of Lower Waimakariri and West Boundary
 roads. Ref. Site No. 9.

HORIZON	DEPTH	DESCRIPTION	CLAY	SAND	SILT
A	0-23 cm (0-9in.)	very dark grey sandy loam; very friable; moderately developed fine crumb grading down to medium nutty and cast granular structure; indistinct boundary, and	13	17 (0-8 cm)	70
C	23-89cm (9-35in.)	greyish brown sandy loam, sand/loamy sand; friable and very friable; weakly devel- oped blocky and single grain structure; sharp boundary,			
uA) uBC)	89-130cm (35-50 in.)	dark greyish brown silt loam grading down to fine sandy loam; friable; weakly developed medium blocky structure and abundant very fine casts;			
	on	dark greyish brown stony sandy loam grading to sandy greywacke gravels.			

MINERALOGY OF SAND AND CLAY*Minerals in sand 0.02 to 2 mm.

Depth	Horizon	Sand %	Quartz	Acid Feldspar	Andesine	Glass	Muscovite	Biotite	Chlorite	Hornblendes	Pyroxenes	Epidotes	Sericite	Chert
0-8cm (0-3in)	A ₁₁	80	30	35		1	1		3			3	5	30
28-56cm (11-22in)	C ₁₁	80	40	15					5			2	5	30
91-102cm (36-40in)	uA	60	40	40		1	1		5	1		6	5	1

Constituents of clay less than 0.002 mm

Depth	Horizon	Free Fe ₂ O ₃ %	Clay %	Chlorite	Interlayered Chlorite	Illite	Interlayered Mica	Vermiculite - 1	Vermiculite - 2	Mont- morillonite	Feldspar
0-8cm (0-3in)	A ₁₁	0.8	4	14		62		10		10	4
28-56cm (11-22in)	C ₁₁	0.6	8	11	11	44	9	11			14
91-102cm (36-40cm)	uA	1.0	7			60		15	20		5

* From soil treated H₂O₂ and dithionite; and dispersed 0.02% Na₂CO₃.

CHEMISTRY

Horiz.	Depth	Bulk Dens.	pH	C	N	C/N	CEC	BS	Ca	Mg	K	Na	P Retn
A ₁	0-8cm (0-3in)	1.17	6.0	3.5	.22	15	11.6	93	8.5	1.2	.68	.1	9
	8-20cm (3-8in)	1.23	6.4	2.1	.17	12	9.4	100	8.0	1.2	.41	.0	10
C	28-56cm (11-22in)	1.35	6.4	.5	.04	12	4.3	88	2.7	1.3	.08	.0	8
uA	91-102cm (36-40in)	1.21	6.7	.8	.08	10	8.7	84	5.5	1.9	.07	.1	16
uBC	120-130cm (47-51in)		6.6	.7	.07	10	6.8	81	4.5	1.1	.07	.1	17

AGRICULTURAL NOTES

The Selwyn soils are predominantly shallow, stony, excessively drained and of low fertility. They dry out in the summer and early autumn and pasture production is confined mainly to the spring, late autumn and winter. Interspersed with these light soils are small areas of deeper soils.

The greatest area of these soils lies along the south bank of the Waimakariri; they contain very little shelter and under cultivation are subject to wind blow from the north-west winds.

This area is divided into large blocks which are held under lease mainly by farmers on the better soil types. In the past they were utilised as extensive grazing runs, carrying dry sheep. Cultivation was limited and little attempt was made to improve the native pastures. Recently the area has been closer sub-divided, shelter belts have been planted and improved pastures established. There has been a change from dry sheep, to fat lamb raising.

The establishment of lucerne both for grazing and hay is important in farm development. Subterranean clover, white clover, perennial rye grass and cocksfoot are the main pasture constituents.

Pastures respond to Ca.P and on the lighter soil types Mo. has given a response.

On the deeper soils cash crops of barley and potatoes are sometimes taken, but yields are influenced to a great extent by seasonal conditions. Yields for barley range from 35-40 bushels and potatoes from 4-6 tons per acre respectively.

SPECTROGRAPHIC

Sweet vernal values: P is high, Mn low, Zn high. Mo is higher than in older terrace soils.

MINERALOGICAL

Abundant chert (C.30%) is in great contrast with all the older soils. It appears to be extremely susceptible to leaching and further study of its behaviour is intended. Barrhill is the only other soil on the tour containing appreciable quantities.

Entic Haplustoll.

A _P	0 - 9"	Very dark brown (10YR 2/2) loamy fine sand. The soil is dark gray (10YR 4/1, when dry). The structure is weak crumb to single grain held together by roots.
A ₃	9 - 24"	Light grayish-brown loamy fine sand.
D ₁	24 - 36"	Pale olive (5Y 6/3) massive friable silt.
D ₂	36+"	Cobbles.

This is a droughty soil said to be all developed from stratified alluvium but certainly the surface has been moved about in the wind. The lower banding and cross bedding indicates river alluvium.

For the life of me I can't see why a pit was made here on such a soil. According to charcoal remnants the whole profile is of the order of 600 to 900 years old.

We leave the field a little after 4:00 and go back to Lincoln for high tea after packing.

We leave in the buses at 6:05 for Christchurch and Lyttelton. We pass Christchurch and then take a "scenic" route over the mountains. I could have done without this. The road is narrow, steep, winding, and without guard rails. We come on to the dock at Lyttelton at 7:20 and go on board. The booking agent took advantage of the boys. Four of us were put in about the tiniest room I ever saw. I probably should have used my plane ticket as far as Wellington instead of this trip on a motor ship.

In a little while Bill Johnson gets a larger room for two of us for 5 shillings apiece extra.

Then Dudal, Tavernier, and I have a long discussion about his work in FAO, including the large regional maps and the enormous job required for a World Soil Map of any use for direct agricultural interpretation. I also emphasize the importance of rather frequent visits to the soil survey parties in order to maintain morale and balance in the work.

Then to bed.

After traipsing around this water plant we are taken for a look at the city library and theatre. Then we have lunch.

November 11: I am up about 5:30 and go out to see the approach to Wellington Harbor. (K-3084). The boat docks at 7:00 and we are off at 7:10 and have a long walk with our bags to the bus. We go to the Grand Hotel but there is a good deal of confusion about rooms. But after breakfast I get one to myself. I unpack, wash my shirt, and get ready to go out again in the buses. I have two letters from home.

At 9:30 we go to the Lower Hutt Pumping Station. We are seated for lectures. Most of us are saturated with this sort of thing but I guess there is no help for it since Norman Taylor has arranged it. His Worship the Mayor of Lower Hutt, Mr. P. Dowse, speaks to us about the new water plant for mixing sodium flouride into the water supply in order to reduce the high incidence of dental caries. Mr. Bates, the engineer, tells us about the plant and the several checks made on the amount of flourine in the water. Chemists of the Ministry of Health make additional checks at irregular intervals and send people to check on the methods of analysis. They now use sodium silicoflouride with about 63 percent of F.

After traipsing around this water plant we are taken for a look at the city library and theatre. Then we have lunch.



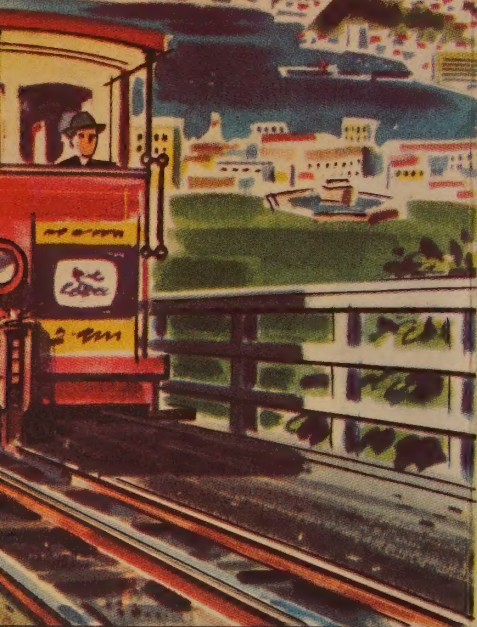
K-3084 November 11, 1962. New Zealand. Near Wellington. On board ship. R, O'Connor; 1, Johnson.

K-3084 November 11, 1962. New Zealand. Near
Wellington. On board ship. R. O'Connor,
J. Johnson.



er's guide to

WELLINGTON



.Z. BANK

ND NEW ZEALAND BANK LIMITED

Parliament Buildings, Wellington



Main Government

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Dominion Farmers' Institute, cr.
Featherston and Ballance Sts.

AIR DEPARTMENT:

Bunny Street.

ARMY DEPARTMENT:

Featherston Street.

ATTORNEY-GENERAL'S OFFICE:

Parliament Buildings.

AUDIT DEPARTMENT:

Departmental Building, Stout St.

BOARD OF TRADE:

Departmental Building, Stout St.

BROADCASTING SERVICE:

Departmental Building, Bowen St.

BUILDING CONTROLLER:

Min. of Works, Departmental
Building, Stout Street.

CUSTOMS DEPARTMENT:

Situated Port of Wellington.

DEPARTMENT OF STATISTICS:

Hoods Building, The Terrace.

EARTHQUAKE AND WAR DAMAGE COMMISSION:

State Fire Building, Lambton
Quay.

EDUCATION DEPARTMENT:

Government Bldg., Lambton Qy.

EXTERNAL AFFAIRS DEPARTMENT:

Parliament Buildings.

FOREST SERVICE—N.Z.:

23 Fitzherbert Terrace.

GEOLOGICAL SURVEY DEPARTMENT:

State Fire Building, Lower Hutt.

GOVERNMENT PRINTING AND

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Lambton Quay.

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Ballance Street.

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Departmental Building, Bowen St.

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Departmental Building, Bowen St.

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Inland Revenue Building, Cnr.
Manners and Taranaki Streets.

INSPECTOR OF WEIGHTS AND MEASURES:

Inland Revenue Building, Cnr.
Manners and Taranaki Streets.

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Departmental Building, Bowen St.

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Departmental Building, Stout St.

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Justice Building, Lambton Quay.

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51-277

70-219

51-595

54-775

54-320

10 Kent Terrace, C.3.

19 Dixon Street, C.1.

Willis Street, C.1.

107 Manners Street, C.1.

75 Manners Street, C.1.

61 Courtenay Place, C.3.

75 Courtenay Place, C.3.

109 Manners Street, C.1.

Embassy

Kings

Majestic

Plaza

Regent

State

St. James

Grand Opera House

corner of Lambton

Marston St., C.1.

Lambton Quay, C.1.

Madison Street, C.1.

Madison Street, C.1.

Madison Street, C.1.

Madison Street, C.1.

Churches

Central Baptist

St. Andrew's (Presbyterian)

St. John's (Presbyterian)

Basilica of the Sacred Heart (Roman Catholic)

St. Mary's of the Angels (Roman Catholic)

St. Paul's Cathedral (Church of England)

St. Peter's Church of England

St. Peter's Church of England



November 11, 1962. New Zealand
On ship near Wellington. O'Connor, CEK,
Tavernier. (Photo by W. M. Johnson.)

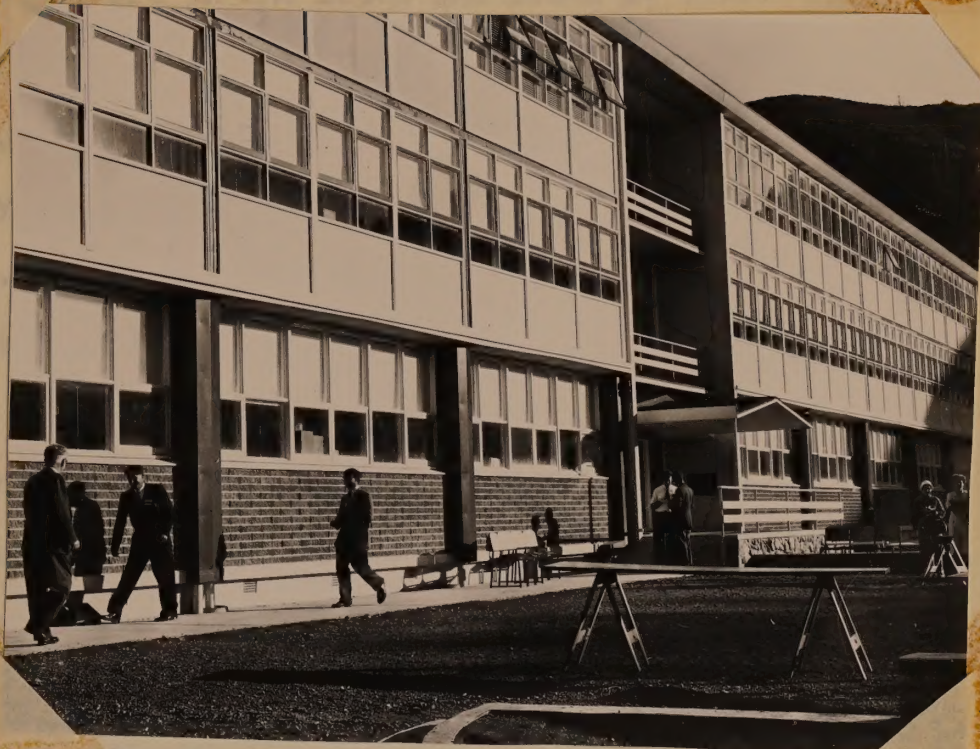


November 11, 1962. New Zealand
Norman Taylor near mural in new soils building
at Lower Hutt. (Photo by W. M. Johnson.)

After the luncheon we go to the new and nice quarters of the Soil Bureau. The building is completed and most of the work has been moved in but not all of it. (K-3085). Mr. Taylor has spent a great deal of time planning this and is very proud of it. A beautiful mural with a Mauri theme faces the entrance hall. On the side of the entrance hall in a glass case is a large Mauri carving that presumably gives the history of the Soil Bureau. I meet the artist, who is the same one that made the fine Mauri box that was presented to Mommy and me by the New Zealand Ambassador here in Washington in the summer of 1952.

Norman Taylor and one or two others make short speeches. Unhappily I can scarcely stay awake I am so tired. Later I have some nice chit chat with Norman and then we go down for tea on the porch of the building and talk with other people.

We are back at the hotel at 6:30. After dinner I take a short walk and pass a bookstore that looks very interesting but we shall leave in the morning before it is open. A little chit chat with René and to bed.



K-3085 November 11, 1962. New Zealand. Lower Hutt.
New Soils Building.

X-3082 November 11, 1962. New Zealand. Lower Hut
New Sofia Building.

November 12: Again I awaken by Honolulu time. This promises to be a fine day. I pack and then have morning tea with the newspaper - a poor one. Immediately after breakfast we are in the buses and leave at 9:07. We drive through Hutt and into the Rimutaka Hills. These are very rugged and result from the uplift of the greywacke in Early Pleistocene. Some phyllite and other rocks poke through. The cover is mostly gorse, manuka, and other shrubs that are great fire hazards in a country so hard to walk over. The day is still and sunny but normally the winds are strong along this mountain road. Along the road are beautiful specimens of toe-toe grass, a tall feathery tussock-like plant. We pass Featherston about 10:37. Along here are several windbreaks of P. radiata. Recently developed pastures are said to carry about 5 ewes per acre. (K-3086).

We stop to look at the Wharekaka silt loam in a badly prepared road cutting. (K-3087). The New Zealanders call this a yellow-grey earth. We should likely call it a Sol Brun Acide with fragipan and, possibly, a Fraglossudalf. There are too many people and too little time to prepare a proper profile.



K-3086 November 12, 1962. New Zealand. Near Featherstone. View of pasture land recently improved, carries 5 ewes to the acre. Some plantings of P. radiata.

X-3886 November 12, 1962. New Zealand. Near Featherstone. View of pasture land recently improved, carries 2 ewes to the acre. Some plantings of P. radiata.



K-3087 November 12, 1962. New Zealand.
A bit east of Featherstone. Profile of Wharekaka silt loam - Sol
Brun Acide with fragipan or possibly
Fraglossudalf (?).

8.18

K-3087 November 12, 1902. New Zealand.
A bit east of Featherstone. Pro-
file of Wharakaaki still loam - 301
Brun Acidic with trappan or possi-
Preslossudall (?).

- A₁ 0 - 3" Grayish-brown (2.5Y 5/2; dry; 2.5Y 3/2, moist) silt loam with mixed fine granular and fine blocky. Many grass roots. Some worm activity.
- A₂ 3 - 7" Pale brown when dry (10YR 6/3) and olive brown when moist (2.5Y 4/4) silt loam with poorly developed medium blocky structure; easily friable; some filled wormholes. A few small Mn-Fe concretions near the lower boundary.
- B₁ 7 - 14" Nearly massive dark yellowish-brown (10YR 4/6) heavy silt loam, mottled with blotches a bit grayer and a bit browner.
- B₂ (Frag.) 14 - 48" This is similar to the above but with an increase in clay, firmer, and more strongly mottled. The soil is grossly prismatic with some nearly vertical gray streaks. The hard irregular prisms break into angular fragments. In the lower part the color gradually changes to yellowish-brown and merges to a C₁ or B₃. In places gravel appears at about 5 to 6 feet.

This material above the gravel appears to be loess that has been a bit reworked by water.

No good place has been prepared for pictures. I make one and then before I can get my description completed others crowd me out to use my place for their pictures. These soils are said to be quite dry during much of the period from October to February. Both lime and phosphate are needed and potash responds on some paddocks. Under good management it is claimed that the pasture will carry about 5 ewes per acre plus some cattle.

Near Greytown we see thin soils over gravel. We are told that subterranean clover does well here with top dressing. Many of the farms along this road look quite fine but here and there I see some ratty ones.

We are now to look at another soil from ash over gravel - the Kopua stony silt loam. This is called locally "a moderately to strongly leached, scrub melanised yellow-brown loam from alluvium." It is said that areas here have summer droughts.

Again we have a badly prepared road cutting at the margin of a gravelly terrace with some ash in the upper alluvium. The surface foot or so has slightly less gravel and cobbles than the lower part. The surface 2 to 5 inches is a dark grayish-brown cobbly loam. There seems to be an incipient hard pan at 24 to 30 inches. Although the clay content is low there is evidence of clayskins. The soil somewhat resembles our Fox gravelly cobbly loam.

We stop in Masterton for lunch about 1:00 p.m. and leave about 2:00 p.m.

I see some more wheat that shows evidence of nitrogen deficiency. I fear that our New Zealand colleagues have a little prejudice against the use of nitrogen fertilizer.

A little further on we make a brief stop to see the Matamau clay loam - a yellow-brown earth. We look at it in a mixed up road cutting. The soil is hilly and resembles a lithosolic Yellow Podzolic. It reminds me of the Yellow Podzolics in the Low Congo that are near the Yellow Latosols. There have been so many slips here that

the horizons are discontinuous and the profile is not worth even a hurried description. (K-3088; K-3089; K-3090).

We pass Eketahuna about 3:30. Along here I try for some slips on improved pasture growing on yellow-brown earth soils. (K-3091).

We pass Woodville about 4:00 and enter the dramatic Manawatu Gorge. The road is narrow and winding.

We go in the direction of Palmerston North. The engine in the bus fails just on the edge of the city. Happily we are near a house with a telephone. The driver orders another bus. (I fear that he pushed the bus too hard in the mountains this morning.) We unload all the baggage and wait. We had hoped to arrive early so this is bad luck but nothing like what it would have been had the bus failed in the Gorge.

We come to Massey College in the relief bus about 5:30 and I'm assigned to Room 28 in the Pink Hostel. Here I meet Aubert and many others.

After dinner I have a long talk with Aubert. He feels very badly about the political and military situation in both France and Algeria.

A bath and early to bed.



K-3088 November 12, 1962. New Zealand. North of Masterton. Topdressed and oversown pasture on Matamau Clay loam. Note slips.



K-3089 November 12, 1962. New Zealand. North of Masterton. Our tour guides, Dr. K. F. O'Connor, l., and M. L. Leamy, r.

K-3088 November 12, 1962. New Zealand. North
of Masterton. Topressed and oversown
pasture on Matamou Clay loam. Note slight

K-3089 November 12, 1962. New Zealand. North
of Masterton. Out four guides, Dr. K. I.
O'Connor, I., and M. J. Leamy, Jr.



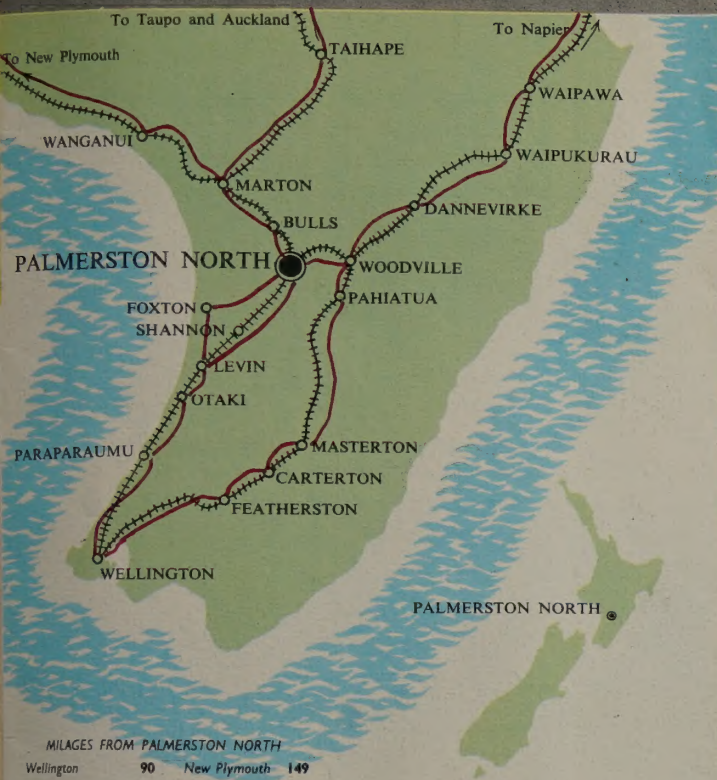
K-3090 November 12, 1962. New Zealand. North of Masterton. Tavernier and others at roadside cutting.



K-3091 November 12, 1962. New Zealand. Near Eketahuna. Slips on improved pasture - on yellow-brown earth soil.

X-3090 November 12, 1962. New Zealand. North of
Masteron. Taverier and others at road-
side cutting.

X-3091 November 12, 1962. New Zealand. Near
Ekaterina. Slips on improved pasture
on yellow-brown earth soil.



MILES FROM PALMERSTON NORTH

Wellington	90	New Plymouth	149
Auckland	343	Wanganui	46
Hamilton	262	Napier	115
Rotorua	219	Waikato	223
Chateau Tongariro	140	Taupo	164

GTB ★
 ★ **Government Tourist Bureau**
 or Associated Travel Agent is at your service

For further information write or call
PUBLIC RELATIONS OFFICE
 P.O. Box 474 22 Grey Street Telephone 2257
 Palmerston North

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 Whitcombe and Tombs Ltd., Wellington, New Zealand.
 N.I. 15

Palmerston North



**THE CITY
 OF FRIENDLY
 CHARM**

NEW ZEALAND



Palmerston North is a riot of colourful blossom in springtime.



The beautifully laid out Manawatu golf course at Hokowhitu.

HOLIDAY PLEASURE

AROUND THE GARDEN CITY

All tourists want to see places and things typical of the country they visit.

Come to Palmerston North, heart of the Manawatu Plains, to see a small city of great charm with all the features of a typical centre of one of those rich farming districts that are the pride of New Zealand. Palmerston North is a prosperous, friendly place, with lovely parks and gardens, spacious modern buildings, a good shopping area, and abundance of flowers.

The people are active, smart, and extremely hospitable. They like you to visit their city and they go out of their way to inform and assist you on every occasion.

Palmerston North has an atmosphere, an aura of solid wealth and achievement. You will certainly feel at home in this friendly garden city.



Famous Massey Agricultural College where students from all over the world are trained in modern farming techniques.



The Civic Square, dominated by the sound shell, is the city's focal point.



WELCOME TO PALMERSTON NORTH

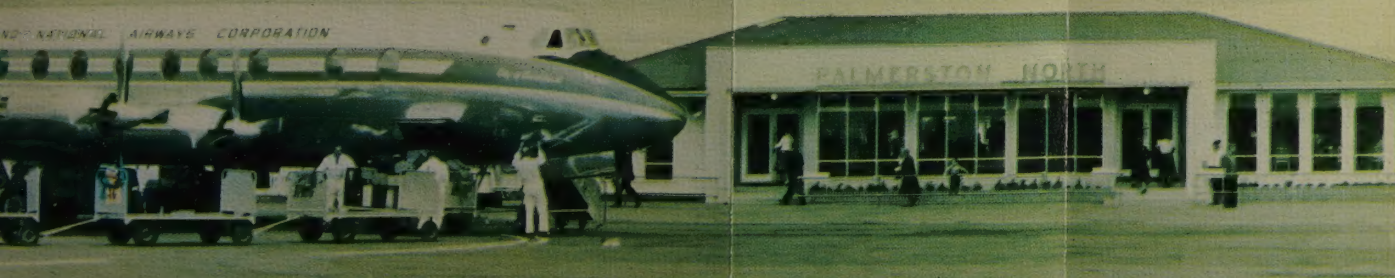
Palmerston North Airport, 3 miles from the centre of the city, is an important air centre, free from geographical hazards and climatic interruptions. This airport was the terminus of the first England - New Zealand flight, and is now one of the four major airports of New Zealand.

Besides being on the main air route, Palmerston North is linked by good roads and modern coach and railway transport to all points of the compass.

The efficient handling of transport throughout has made Palmerston North the safety city.

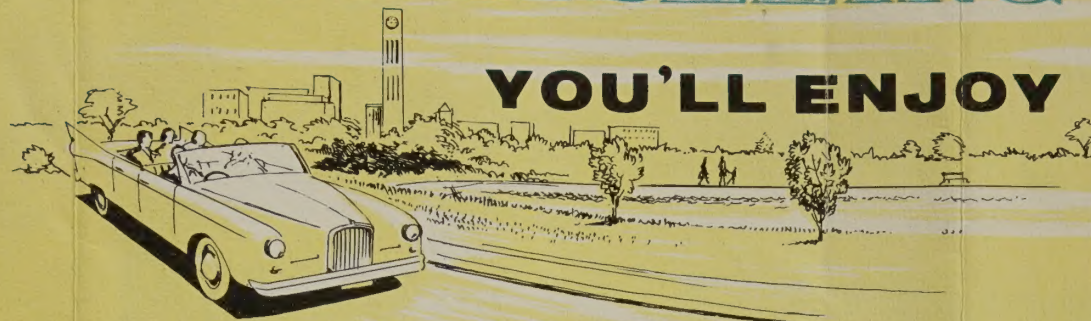


The city's modern bus terminal.



SIGHTSEEING

YOU'LL ENJOY



Centre of prosperous Palmerston North is the Square. In the heart of the city are 17 acres of colourful flower beds and fine trees dominated by the sound shell which is the focal point for many civic gatherings. The Main Trunk railway line, running through the centre of the Square, makes an unusual feature.

A mile from the Square are the Botanical Gardens and Esplanade with 360 acres of forest, shrubberies, and flower gardens, a conservatory, an aviary, and a children's play area. Visitors throng the Esplanade in springtime to see the famous cherry blossom drive. A modern, well equipped motor camp is nearby.

Attractively appointed Awapuni Racecourse, a mile from the city, caters for Palmerston North racegoers and many visitors.

There are good golf courses, bowling and croquet greens, tennis courts, and swimming baths handy to the city.

Palmerston North is surrounded by wide pasture lands on which graze hundreds of thousands of the best sheep and cattle of New Zealand. Stately homesteads testify to the prosperity of this agricultural district.

To the east, the geographic boundary of the Manawatu district is a mountain range, passage through which is by the Manawatu Gorge, some 4 miles in length. Railway and highway through the gorge offer beautiful scenic vistas.

A new university college has just been established in Palmerston North, situated on the banks of the beautiful Centennial Lake near the Manawatu River.



The spacious square in the heart of the city.



The rugged Manawatu Gorge forms a portal to the city from the north-east.



Fitzherbert Bridge spanning the Manawatu River is one of the main entrances to the city.



Sportsmen will find expert service in the well stocked stores.



Rich farming lands surround Palmerston North.

1.

MICHAEL ROWS THE BOAT ASHORE
ALLELUIA
KEVIN TELLS THE TRAVEL LORE
ALLELUIA

2.

KELLOGG EYES THE PROFEEL DOWN
ALLELUIA
IN CUPS OF TEA HE'LL SURELY DROWN
ALLELUIA

3.

TAVERNIER THE LEGIONNAIRE
ALLELUIA
FIRST TO SNIFF THE MORNING AIR
ALLELUIA

4.

SCHLICHTING COUNTS THE CHEMISTRY
ALLELUIA
ADDS IT UP FROM A TO ZEE
ALLELUIA

5.

GLENTWORTH, OCH! BELIEVES HE'S SEEN
ALLELUIA
SOILS QUITE LIKE IT IN ABERDEEN
ALLELUIA

6.

LOXTON'S HAT IS SURE LOCKED ON
ALLELUIA
BUT FRAGIPANS ARE DROWNED UPON
ALLELUIA

7.

JOHNSON'S FOUND A HAPLAQUOL
ALLELUIA
AND HAS QUITE AN EYE FOR A PRETTY DOLL
ALLELUIA

8.

JENSEN'S WON THE GREENSTONE PRIDE
ALLELUIA
CAPPING TEETH WITH FLOURIDE
ALLELUIA

9.

SWAFY'S ALL THE FLORA STOLE
ALLELUIA
REFERRED BY NOW TO INTERPOL
ALLELUIA

10.

SAUNDER LIKES HIS SULPHUR TRIALS
ALLELUIA
THOMAS LEAVES HIS KNIVES IN PILES
ALLELUIA

11.

STONEMAN HAS A NEW FOUND TASTE
ALLELUIA
WATER WITH WILLIAMS BOURBON LACED
ALLELUIA

12.

DUDAL LEADS OUR SINGING CLUB
ALLELUIA
GRAND PREMIERE IN THE CROMWELL PUB
ALLELUIA

13.

MARECHAL WILL PHOTO ROCKS
ALLELUIA
MAKES FINE SPEECHES AFTER SCOTCH
ALLELUIA

14.

VIETS POW WOWED IN TIMARU
ALLELUIA
BROUGHT REAL GLAMOUR TO S7 TOO
ALLELUIA

15.

GROBLER, SCHOLAR, SPRINGBOK TALL
ALLELUIA,
PENELOPE MARY IS "CUDDLES" TO ALL
ALLELUIA

16.

ORBELL EXPOUNDS GEOLOGY
ALLELUIA
KEAR RECORDS FOR HISTORY
ALLELUIA

NOTED FRENCH SCIENTIST ARRIVES



Professor Dr G. Aubert (left), a noted French soil scientist, pictured at Massey College yesterday.

November 13: Up early and tea at 7:30 with Norman Taylor. A poor breakfast and then into the city. Sherman of Hawaii tells me that he thinks Norman Taylor will be offered a professorship at the East-West Center in the University of Hawaii.

I buy some soap, cookies, bananas, and a greenstone set for Mommy. I had taken my razor in for fixing and get it back. Now I sit in the airport trying to get information about a flight to Auckland on a Saturday. The people promise to send the revised tickets out to Massey College.

Several of us return by bus and have lunch. Then the whole group of us go back to the city opera house for the opening session of the Conference. (I suppose around 200 are staying at Massey College and another 100 in homes and hotels.) We have speeches by the Minister of Scientific and Industrial Research, Mr. W. B. Tennent; by His Worship the Mayor of Palmerston North; by Mr. Nash, Leader of the Opposition; by the Minister of Agriculture, Mr. Tallboys; and by Prime Minister Holwoke. Of course, they all say that soil science is very important. Mr. Nash has the answer for New Zealand and the world: Produce and distribute powdered milk. (Somebody ought to tell him that warehouses are full but people don't know what's good for them.)

Mr. Norman Taylor makes an excellent address as President of the Conference. Professor F. Scheffer gives the reply. We are then back at Massey College around 5:00.

We soon have dinner and are taken back down town again for a reception by His Worship the Mayor of Palmerston North and Councillors of the city of Palmerston North.

Butler of Australia tells me that Dr. C. G. Stephens was not included in the government list to come to New Zealand after FAO "withdrew" a plan for a meeting of the advisory committee on the World Soil Map. (I never knew that FAO ever had such a plan.) But Butler says that he didn't think Stephens was keen to come anyway.

Then there are more speeches. Aubert makes the reply in both French and English and it is much too long. One of the local boys takes pity on me and brings me back to my room at 10:30.

And so to bed.



THE PRESIDENT AND ORGANISING
COMMITTEE OF THE 1962 INTERNATIONAL
SOIL CONFERENCE

have much pleasure in inviting

Dr C. E. Kellogg

to the

OFFICIAL OPENING OF THE CONFERENCE
BY THE RT. HON. THE PRIME MINISTER

AT THE OPERA HOUSE, PALMERSTON NORTH,
ON TUESDAY, 13th NOVEMBER, 1962,

AT 2.30 p.m.

R.S.V.P.

Phone 48-650, Ext. 729

or P.O. Box 8001, Wellington.

Dress:

Informal

*The Times, Palmerston
North, 14 November, 1962*

cision

CONFERENCE DELEGATES ENJOY CITY SUNSHINE



Three delegates to the International Soil Conference photographed outside the Opera House after the opening of the conference by the Prime Minister, Mr Holyoake, yesterday. From left, Professors R. Marechal and R. S. F. Tauernier, of Belgium, and Dr C. E. Kellogg, U.S.A.

INTERNATIONAL SOCIETY OF SOIL SCIENCE
JOINT MEETING OF COMMISSIONS IV & V.



CONFERENCE GUIDE

MASSEY COLLEGE, PALMERSTON NORTH,
NEW ZEALAND, 13-22 NOVEMBER 1962

CONFERENCE GUIDE

Joint Meeting of

COMMISSION IV: SOIL FERTILITY AND PLANT
NUTRITION

and

COMMISSION V: SOIL GENESIS, CLASSIFICATION,
AND CARTOGRAPHY,

International Society of Soil Science

New Zealand, 1962

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FOREWORD

by the **Hon. W. B. Tennent**,
*Minister in charge of the
Department of Scientific and
Industrial Research*



ON BEHALF of the Government of New Zealand I extend a very warm welcome to all those who will be attending this Conference of the International Society of Soil Science. New Zealand feels itself honoured at being the host to such a distinguished gathering of scientists.

The importance of soil science is appreciated by the Government, who have been pleased to act as sponsors for this Conference. Responsibility for the organisation of the Conference has been undertaken by Soil Bureau, in collaboration with the New Zealand Society of Soil Science, and it has been a pleasure to place the facilities of my Department at their disposal.

The material prosperity of New Zealand depends chiefly upon the products of the land, and it is thus of the greatest importance to us to understand and utilise our soils to the best advantage. We feel confident that we shall benefit considerably from the stimulus given us by the number of world authorities here present. We trust that our visitors will also profit from this Conference and enjoy their tours of our country.

I wish the Conference every success.

Blair Tennent.

CONFERENCE OFFICERS

	<i>Room No.</i>
<i>President of Conference:</i> Mr N. H. Taylor	B.2
<i>Past President, Commission IV:</i>	
Prof. Dr F. Scheffer	C.4
<i>President, Commission V:</i>	
Prof. Dr G. Aubert	C.4
<i>Principal, Massey College:</i> Dr A. Stewart	
<i>Secretary-General:</i> Dr R. B. Miller	B.3
<i>Administrative Secretary:</i>	
Mrs J. H. van Roekel	A.1
<i>Committee Secretaries:</i>	
<i>Exhibition:</i> Dr W. M. H. Saunders	Wool Room
<i>Local Arrangements:</i> Dr H. Jacks	A.3
<i>Programme:</i> Dr R. D. Northey	C.2
<i>Publicity, Publications:</i> Mr A. J. Metson	A.4
<i>Tours:</i> Dr W. B. Healy	A.2
<i>Accommodation Officer:</i>	
Mr M. R. Jensen, 22 Grey St., Palmers- ton North; or with P.R.O., Massey College (see below)	
<i>College Warden:</i> Mr P. A. McGillivray	A.1
<i>Transport Officer:</i> Mr J. A. Pollok	A.2
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<i>Conference:</i> Mr G. Boyle	B.4
<i>College:</i> Mr C. Palmer	(Registrar's Building)
<i>Palmerston North:</i> Mr M. R. Jensen	(See above)
<i>Recording Officer (Discussions):</i>	
Mr M. L. Leamy	C.3
<i>Editor (Transactions):</i> Mr G. J. Neale	A.4
<i>Press Liaison Officer:</i>	
Mr H. Woodyear-Smith	B.4
<i>Radio Liaison Officer:</i>	
Mr J. D. McCraw	B.4

AIMS OF THE CONFERENCE

THIS CONFERENCE has been envisaged from the start as an opportunity for soil scientists of Commissions IV and V to get together and do some hard thinking on the inter-relationships of their fields of work. It is designed to be a working Conference with a minimum of formal presentation of papers and a maximum of discussion directed to the clarification of a limited number of clearly defined problems.

In a limited Conference such as this, only a selection of the many papers sent in could be accepted. These have been arranged into a programme which should provide many stimulating lines of discussion and, we hope, some profitable conclusions.

The Tours are an integral part of the Conference and the routes and soil sites have been so chosen and documented as to allow critical consideration of the soils, their environment, and their utilisation.

In the Soils Exhibition it will be possible to see monoliths of New Zealand soils in perspective and gain an appreciation of their distribution, classification, properties, and uses. Monoliths from many countries of the world will also be on view, and the thanks of the Organisers are due to all those who have co-operated by sending in contributions to this exhibition.

Members from all parts of the world will bring to the Conference a great wealth of knowledge and experience. Our aim will be by constructive discussion to assist in the solution of the complex problem of producing maximum yields from the many and varied soils of the world, and at the same time conserving and improving them for the benefit of future generations.

Norman H. Taylor.

President of Conference

COMMITTEES

PRESIDENT OF CONFERENCE: Mr N. H. Taylor

International Society of Soil Science

Past President, Commission IV: Prof. Dr. F. Scheffer
President, Commission V: Prof. Dr. G. Aubert

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Deputy Chairman: Dr J. K. Dixon

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Mr F. R. Callaghan

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Mr I. L. Elliott

Mr S. H. Saxby

Mr H. Woodyear-Smith

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Administrative Secretary: Mrs J. H. van Roekel

The following also served for a time on the Organising Committee:

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Mr P. W. Smallfield

Prof. T. W. Walker

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Mr C. During

Mr R. S. Lutton

Mr I. L. Elliott

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Mr F. J. Tindall

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Mr J. A. Graham	Dr K. J. Mitchell
Mr D. C. Hounsell	Mr C. Palmer
Dr R. H. Jackman	Mr H. C. H. Pearse
Mr M. R. Jensen	Mr J. A. Pollok

Secretary: Dr H. Jacks

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Members

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Mrs H. Jacks	

Secretary: Mrs A. W. Hudson

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Dr J. K. Dixon	Mr P. B. Lynch
Dr M. Fieldes	Mr A. L. Poole
Mr C. V. Fife	Dr R. H. Thornton

Prof. T. W. Walker

Secretary: Dr R. D. Northey

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Dr E. B. Davies	Mr J. D. Raeside
Mr C. During	Dr S. D. Richardson
Mr I. L. Elliott	Mr N. H. Taylor
Dr M. Fieldes	Dr R. H. Thornton
Mr P. E. Noble	Prof. T. W. Walker

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Dr D. J. Ross

Mr M. O'Connor

Mr T. G. Tyrer

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Members

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Dr W. M. Hamilton

Mr D. A. Campbell

Mr S. H. Saxby

Mr H. S. Gibbs

Dr R. H. Thornton

Mr H. Woodyear-Smith

Secretary: Dr W. B. Healy

ACKNOWLEDGMENTS

THE 1962 SOIL CONFERENCE has been arranged by the Organising Committee, which was set up in 1957 by the New Zealand Society of Soil Science. It has been financed by a grant received from the New Zealand Government through the co-operation of the Department of Scientific and Industrial Research. Without this assistance it would have been impossible for a comparatively small country such as New Zealand to have undertaken a task of this magnitude.

Substantial additional support has been received from many other New Zealand organisations, and the money contributed has helped in providing the extra materials and facilities so necessary for the smooth running of a Conference of this kind.

We gratefully acknowledge grants from the following organisations:

New Zealand Bankers' Association
New Zealand Dairy Production and Marketing Board
New Zealand Farmers' Fertilizer Co. Ltd.
New Zealand Wool Board
Tasman Pulp and Paper Co. Ltd.
Kempthorne Prosser and Co.'s New Zealand Drug Co. Ltd.
Atlantic Union Oil Co. New Zealand Ltd.
Auckland Farmers' Freezing Co. Ltd.
British Phosphate Commissioners
Canterbury Frozen Meat Co. Ltd.
Crusader Shipping Co. Ltd.
East Coast Farmers' Fertilizer Co. Ltd.
Europa Oil (New Zealand) Ltd.
New Zealand Grain, Seed and Produce Merchants' Federation
Potash (New Zealand) Ltd.
Shell Oil New Zealand Ltd.
Union Steam Ship Co. of New Zealand Ltd.
Williams and Kettle Ltd.
Geo. W. Wilton & Co. Ltd.
Federated Farmers of N.Z. Inc.
W. D. and H. O. Wills (New Zealand) Ltd.
New Zealand National Airways Corporation
Southland Co-operative Phosphate Co. Ltd.
Watson Victor Ltd.
Cadbury Fry Hudson Ltd.
Hawke's Bay Farmers' Meat Co. Ltd.
Sulphur and Chemical Importing Co. Ltd.
Hodder and Tolley Ltd.
Borax Consolidated Ltd.
Levin and Co. Ltd.

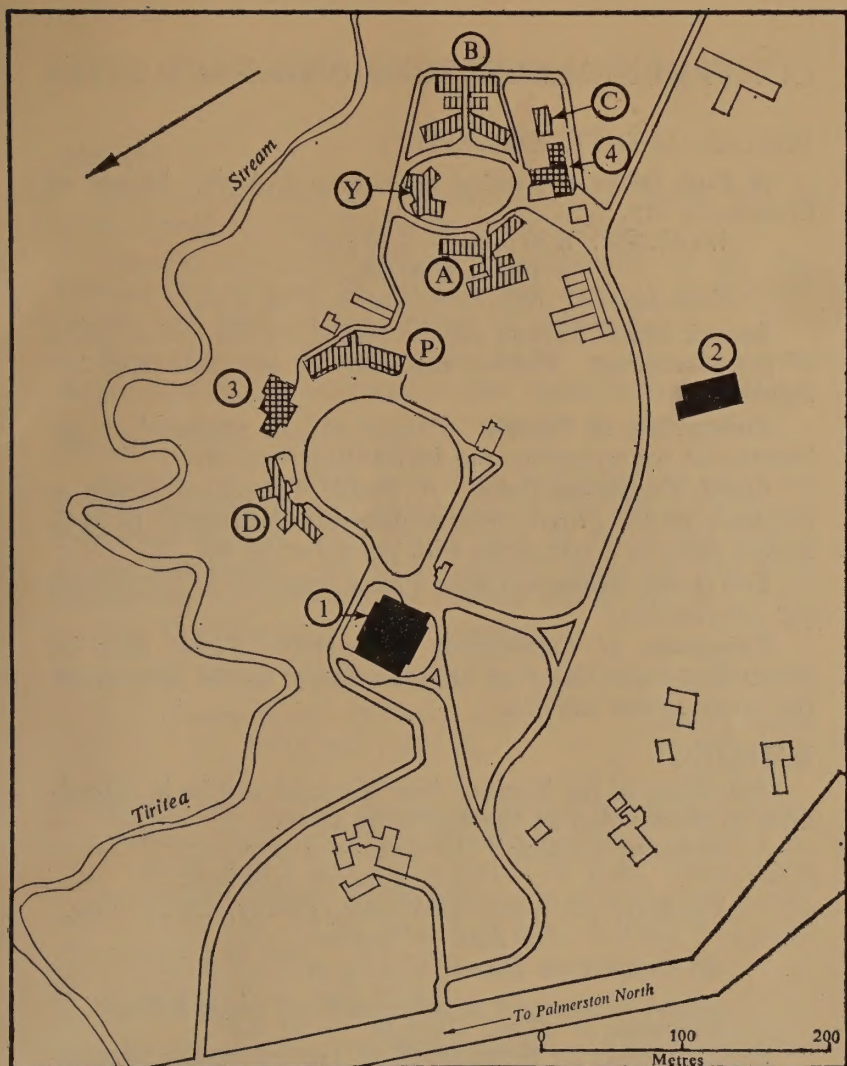
VENUE OF THE MEETING

MASSEY COLLEGE, Palmerston North, is one of the six University institutions in New Zealand and one of the two Agricultural University Colleges, the other being Lincoln College, near Christchurch, in the South Island. Massey College was established in 1926 and named after a former New Zealand Prime Minister. Since 1928, when teaching facilities first became fully available, the College has supplied increasing numbers of graduates for research and extension services, and holders of diplomas to New Zealand's primary industries. Many former students are now employed overseas. The College enjoys an international reputation, and at present on the Campus there are one hundred overseas students, representing twenty nationalities.

During 1962, 620 students studied at the College. Of these, approximately 360 took degree subjects and 260 were on diploma courses.

Detailed accounts of College activities are given in pamphlets published by the College, which will be issued to Conference Members.

The Organising Committee are very grateful to the Principal, Dr A. Stewart, the Council, and the Staff of Massey College for their help and co-operation in making the facilities of the College available for this Conference. Their generous assistance has done much to ensure the success of the Meeting.



PLAN OF FACILITIES AT MASSEY COLLEGE

1. Main Science Block, Dairy Research Institute, and Lecture Hall (Conference Headquarters)
2. Wool Room (Exhibition)
3. Refectory
4. Common Room
- A. Hostel "A"
- D. Hostel "D"
- B. Hostel "B"
- Y. Hostel "Y"
- C. Hostel "C"
- P. "Pink" Hostel

CONFERENCE SERVICES AND FACILITIES

POSTAL AND TELEGRAPHIC

A **Post Office** is located at Massey College. Hours of attendance are:

Weekdays: 8.30 a.m. — 4.30 p.m.

6 p.m. — 8 p.m.

Saturday, 17 Nov.: 9 a.m. — 11 a.m.

Inward Mail: Letters will be placed on the notice-board of the Secretariat. Further inquiries can be made from the Secretariat.

Forwarding of Parcels: Parcels will be accepted at the Secretariat for wrapping and forwarding overseas.

Local Telephone Calls: A Public Telephone Booth is available on the ground floor underneath the stairs. In each Hostel there is a telephone with notes for its use.

Toll (Long Distance) Calls: Please apply to the Secretariat for information.

Telegrams or Cablegrams (Outward): These may be dispatched from the Post Office. Apply to the Secretariat for After Hours Service.

BANKING

An officer of the Bank of New Zealand will be in attendance in Room A.3 at the following hours:

Monday, 12 Nov.: 10 a.m. — 3 p.m.

6.30 p.m. — 7.30 p.m.

Tuesday, 13 Nov.; Thursday, Friday, 22-23 Nov.:

10 a.m. — 3 p.m.

All Conference Days: 12.30 p.m. — 2 p.m.

6.30 p.m. — 7.30 p.m.

Saturday, 17 Nov.: 10 a.m. — 11 a.m.

Banking hours for Branches of all Trading Banks throughout New Zealand are 10 a.m. to 3 p.m., Monday to Friday.

TRAVEL

A representative of the Travel Department of Dalgety and New Zealand Loan Limited will be in Room A1 during the Meeting at Massey College for the convenience of Members wishing to arrange private tours or make onward bookings. Hours of attendance will be notified in the Order of the Day.

LOCAL TRANSPORT ARRANGEMENTS

Arrival

Members arriving by pre-Meeting Tour buses will be taken directly to their hotels or to the College.

Overseas Members arriving independently of the pre-Meeting Tours will be met at the Airport or Railway Station and taken to their places of residence.

New Zealand Members are asked to use their own initiative in finding their way to their hotels or to the College.

SPECIAL BUS SERVICES

Special bus services have been organised to serve the routine sessions of the Conference and the official functions connected with it. No charge will be made for Special Conference Buses. On regular (route) buses the fare from Palmerston North to Massey College will be 1/-.

The Bus Timetable is as follows:

1. Special Buses for Conference Sessions (weekdays)

<i>Leave Square, Palmerston North</i>	<i>Leave College</i>
8.45 a.m., 1.45 p.m.	12.30 p.m., 5.30 p.m.

In addition to the above, on weekdays regular (route) buses leave the Square, Palmerston North, at 8.15 a.m., 10.30 a.m., 1.20 p.m., and 3.25 p.m.; buses leave Massey College on the return trip at 8.30 a.m., 9 a.m., 10.45 a.m., 12.20 p.m., 1.30 p.m., 2 p.m., 3.40 p.m., and 4.55 p.m.

2. Special Buses for Functions in Palmerston North

	<i>Leave College</i>	<i>Return to College</i>
Official Opening, Tuesday, 13 Nov.	2.15 p.m.	After function
State and Civic Receptions and Public Lectures	8 p.m.	" "

3. Special Bus for Functions at College

	<i>Leave Square, Palmerston North</i>
Reception, Wednesday, 21 Nov.	8 p.m.

4. Special Buses on Free Evenings

	<i>Leave College</i>	<i>Leave Square, Palmerston North</i>
Friday, 16 Nov.	7 p.m.	9.15 p.m. 10.45 p.m.
Tuesday, 20 Nov. } Thursday, 22 Nov. }	7.30 p.m.	10.45 p.m.

5. Special Buses at Weekend (Apart from Local Tours)

	<i>Leave College</i>	<i>Leave Square, Palmerston North</i>
Saturday, 17 Nov.	7.30 p.m.	11.00 p.m.
Sunday, 18 Nov.	10.15 a.m. 2.00 p.m. 6.40 p.m.	12.20 p.m. 5.00 p.m. 8.30 p.m.

6. Special Buses for Weekend and Local Tours

See pages 19-21.

Rental Cars: Tasman Rentals, 15 Princess Street. Telephone 77-079.

Air Flights: The Aero Club at Palmerston North is prepared to run local flights at £2 per hour.

Airlines of New Zealand will arrange private flights around the North Island for about £10 per person, if about 25 members are interested.

Details can be obtained at the Secretariat.

Canteen and Souvenir Stand: Situated in Main Hall. The canteen will be open at most times during the Conference. Details will be advised in the Order of the Day.

Orders for purchase of typical New Zealand foods can be placed at the canteen.

Display of Publications is located in Room A.5.

Casual Meals will be available at the Refectory, Massey College. Charges will be: Luncheon 6/-; Dinner 10/-. Payment should be made at the Secretariat.

Morning and Afternoon Tea will be served between Conference sessions.

Coffee Lounge: Coffee and light refreshments will be available in Rooms A.6 and A.7 from 11 a.m. to 3 p.m., and from 4 p.m. to 5.30 p.m.

Laundry Services will be available at Massey College.

Medical and Dental Services: Addresses may be obtained at the Secretariat. A well equipped sick bay is available at Massey College.

Pharmaceutical Services: After hours service is available at: Urgent Medicine Dispensary, 271 Cuba Street. Telephone 88-287.

Hours: Monday to Thursday, 7-9 p.m.
Saturday, 11 a.m. to 1 p.m.; 7-9 p.m.
Sunday, 11 a.m. to noon; 7-8 p.m.

Optician:

Holland and Sturtevant, 130 Broadway Ave. Telephone 88-781.

Home Telephones: Holland 80-213
Sturtevant 80-223

Hearing Aids:

D. A. Amor & Co., 155 Broadway Ave., Telephone 77-478.

Home Telephone: 87-571.

Barber:

Mr. A. Bell, 62 Andrew Avenue, Telephone 79-591, is available after the usual shop hours from 6 p.m. on weekdays and during weekends.

Florist:

Erland Wright, 489 Main Street, Telephone 89-585.

Shoe and Leather Repairs:

Weekdays: All shoe shops.

Weekends: By arrangement:

Inkpen, Fitzherbert Avenue
Rapid Shoe Repairs, Rangitikei Street.
(Not on Telephone)

Church Services: Addresses of Churches and times of services are given in the Booklet "What's on in Palmerston North".

Clubs:

Citizens' Lunch Club: Meets every Friday at 12 noon in Collinson and Cunninghame's tearooms.

Commercial Travellers' Club, Church Street, offers free membership to visitors during the period of the Conference.

Lions Club of Palmerston North: Meets on second and fourth Mondays of the month at 6 p.m. at the Empire Hotel.

Palmerston North Jaycee: Meets on second and fourth Mondays of the month at 6 p.m. in Jaycee House, Lombard Street.

Rotary Club of Palmerston North: Meets every Monday at 12 noon in Collinson and Cunninghame's tearooms.

Rotary Club of Terrace End: Meets every Wednesday at 5.45 p.m. in Master Builders' Club Rooms, 275 Broadway Avenue.

Sporting Organisations: The *Manawatu Golf Club* and the *Manawatu Bowling, Croquet and Tennis Club* extend an invitation to visitors to use their facilities.

Overseas Members are invited as guests of the *Feilding Jockey Club* to its Race Meeting on Saturday, 17 November.

GENERAL INFORMATION

Please inquire at the Main Conference Office (Secretariat), Room A.1, for additional information.

IMPORTANT

Any late changes or additions will be announced in the daily "Order of the Day" bulletins.

DIPLOMATIC AND CONSULAR REPRESENTATIVES

The following representatives are resident in New Zealand:

Country	Telephone		
	Auckland	Wellington	Christ-church
Australia	22-879	44-412	80-673
Austria	—	55-841	—
Belgium	33-600	44-539	77-905
Canada	—	70-644	—
Ceylon	—	54-073	—
Chile	23-529	—	—
China	—	41-619	—
Czechoslovakia	—	52-429	—
Denmark	24-762	47-099	69-854
Finland	—	45-534	—
France	21-644	40-257	60-085
German Federal Republic	24-357	53-516	—
Greece	—	50-238	—
India	—	44-548	—
Indonesia	34-296	—	—
Italy	34-873	41-307	65-692
Japan	—	57-630	—
Netherlands	20-959	70-119	65-669
The Philippines	23-539	—	—
Switzerland	—	40-283	—
Thailand	—	41-094	—
Union of Soviet Socialist Republics	—	76-113	—
United Kingdom	48-060	46-060	30-822
United States of America	32-526	41-074	65-864
Venezuela	42-266	—	—
Yugoslavia	—	42-303	—

MAIN TOURS

Preferences at registration have determined that the following tours be run:

Pre-meeting Tours

Two Northern tour parties	(N2, N3)
Three Southern tour parties	(S5, S6, S7)

Post-meeting Tours

Three Northern tour parties	(N11, N12, N13)
One Southern tour party	(S16)

The number of tour parties cannot be increased further, as hotel, bus, and aircraft arrangements have now been finalised. However, there are still a few vacancies in various tour parties, and late registration for these will be accepted until parties are full. Members who still wish to join tours should inform Conference officers when registering on arrival in New Zealand, or contact the Tour Secretary at Room A.2, Massey College, Palmerston North.

WEEKEND TOURS

17-18 November)

Tour A (Chateau Tongariro)

This tour leaves Palmerston North by bus the morning of 17 November, crosses the alluvial soils and yellow-grey earths of the Manawatu Plains, and climbs through hill country with yellow-brown earths and steep land yellow-brown earths on to the Central North Island plateau. Here active volcanoes, ash shower deposits, yellow-brown loams, and young soils from volcanic ash can be seen. An overnight stop will be made at the Chateau Tongariro. The tour will return via the Parepara route through Wanganui, passing in general through steep land soils.

Cost of tour (includes bus transport, meals, and accommodation)—£6.

Tour B (Wellington)

This tour is for Members who may wish to see the southern part of the North Island, without taking the full Southern Tour. A round-trip through the Wairarapa, Wellington, and Manawatu districts will cover varied soils and types of farming. The new headquarters of the Soil Bureau, at Taita, near Wellington, will be visited.

Cost of tour (includes bus transport, meals, and accommodation)—£5.

Tour C (West Coast)

This tour will leave Palmerston North by chartered aircraft on 17 November and fly to Hokitika. This flight will be most attractive, covering a considerable range of New Zealand scenery, and providing excellent coverage of the soils and forestry of the West Coast. The well developed gley podzols will be examined at Hokitika, together with native forests. The party will travel by bus to Westport via the Buller Gorge and return by plane to Palmerston North. This is a wonderful opportunity for Members to see part of New Zealand not covered by Main Tours. Unfortunately this party is restricted by the limits of the charter aircraft, but there are still some vacancies.

Cost of tour (includes aircraft, bus, meals, and accommodation)—£18.

LOCAL TOURS

During the Conference at Palmerston North the following Local Tours have been arranged. Further details will be given to Members during the pre-Conference Tours or when registering. Members should advise the Local Tours Officer as early as possible which tours they wish to take:

1. A Full-day Tour on Saturday, 17 November, to examine *Soils and Land Use in the Manawatu District*. Some of the places to be visited are: Peaty soils and market gardening; Moutoa flax-growing area; Lower Manawatu Flood Control Scheme; and sand-dune stabilisation and farming. Cost, 15/-.

Buses will leave the Square, Palmerston North, at 9.00 a.m., and Massey College at 9.15 a.m.

2. Half-day Tours on Saturday, 17 November, and Wednesday, 21 November, to the *Lower Manawatu Flood Control Scheme*. Cost, 10/-.

Saturday, 17 November: Buses will leave the Square, Palmerston North, at 8.30 a.m., and Massey College at 8.45 a.m.

Wednesday, 21 November: Buses will leave the Square, Palmerston North, at 1.30 p.m., and Massey College at 1.45 p.m.

3. Half-day Tours on Saturday, 17 November, and Wednesday, 21 November, to the *Te Awa-Pohangina district*. This tour will be to examine hill country erosion and its control. Cost, 10/-.

Buses on both days will leave from Massey College at 1.30 p.m. and from the Square, Palmerston North, at 1.45 p.m.

4. *Tours of Massey College Campus and Farms*: Tours of the Massey College campus and farms will leave from outside the College administrative office at the following times:

Tuesday,	13 Nov.	9.30 a.m.	finish approx.	11.00 a.m.
Wednesday,	14 Nov.	4.00 p.m.	finish approx.	5.30 p.m.
Wednesday,	21 Nov.	2.00 p.m.	finish approx.	3.30 p.m.
Wednesday,	21 Nov.	4.00 p.m.	finish approx.	5.30 p.m.

Members who are remaining in Palmerston North over the weekend 17-18 November and who wish to see over the campus and farms at this time should contact the Secretariat. It is proposed to begin a tour at 9.30 a.m. on both days.

Some Members may also wish to spend time with individual members of the College staff. This can be arranged through the Secretariat.

5. Tour of *Grasslands Division, D.S.I.R.*, and *Plant Physiology Division, D.S.I.R.* This tour will be run on Tuesday morning, 13 November, Saturday morning, 17 November, and again on Wednesday afternoon, 21 November, departing from Massey College at times to be advised later.

6. *Demonstration of Aerial Farming* on Monday, 19 November.

Buses will leave Massey College and the Square, Palmerston North, at 9.00 a.m.

7. In addition to these organised tours, arrangements have been made for informal visits, if required, to the following places:

Levin Horticultural Research Station

Turf Research Institute

Marton Experimental Farm

Moutoa Flax Estate and Flax Mills

Sand-dune stabilisation and forestry schemes

Plant Chemistry Laboratory, D.S.I.R.

NOTES

PROGRAMME

A **Provisional Timetable** is given in summary form on pp. 24-25, followed by details of the various Conference Sessions planned.

Ladies' Programme

A committee of wives of local Members has been active in arranging entertainment for wives of visitors over the period of the Meeting. Details will be advised in the "Order of the Day" bulletins.

Papers

No papers will be formally read, so that the full 90 minutes of each session will be available for discussion. The author of the invited paper will have 25 minutes to discuss his paper and the contributed papers. This will be followed by 10 to 15 minutes for authors of contributed papers to cover any additional points, and then at least 45 minutes for general discussion before the Chairman sums up.

All authors, including those of papers accepted "by title", will have the opportunity of speaking from the platform, but all other discussion will be from the floor of the hall.

Guide Lines

To obtain most profit from the general discussion it is felt that some guidance to speakers is desirable. It is hoped, therefore, that in each session, Members will steer their contributions to the discussion along the following lines:

1. Discussion of presented papers.
2. (a) Theme in relation to fertility;
(b) Theme in relation to classification;
(c) Inter-relationships of (a) and (b).
3. Chairman's summing up.

PROVISIONAL

Day	Morning	
	9.00-10.30	11.00-12.30
TUESDAY, 13 Nov.	Registration	
WEDNESDAY, 14 Nov.	A.1	A.2
THURSDAY, 15 Nov.	A.4	A.5
FRIDAY, 16 Nov.	B.8	B.9
SATURDAY, 17 Nov., and Sunday, 18 Nov.		
MONDAY, 19 Nov.	Aerial Farming Display	
TUESDAY, 20 Nov.	C.19	C.14
WEDNESDAY, 21 Nov.	C.17	C.18
THURSDAY, 22 Nov.	World Soil Maps	Commission Business

IMPORTANT.—The programme outlined above is subject to change. See "Day" bulletins.

TIMETABLE

Afternoon		Evening
2.00-3.30	4.00-5.30	8.15-
Opening of Conference; Presidential Address (<i>Opera House</i>)		State Reception (<i>Izadium, Palmerston North</i>)
A.3	Free	Public Lecture (<i>Opera House</i>)
A.6	A.7	Civic Reception (<i>Concert Chamber</i>)
B.10	B.11	Free
Weekend Tours, Excursions, etc.		
C.12	C.13	Public Lecture (<i>Opera House</i>)
C.15	C.16	Free
Free		Reception (<i>Exhibition Hall</i>)
D.20	D.21	Free

change. Alterations will be advised in the "Order of the

MONDAY, 12 NOVEMBER

REGISTRATION

TUESDAY, 13 NOVEMBER

MORNING

REGISTRATION

AFTERNOON

(2.30 p.m.)

Opening Ceremony, Presidential Address

(Opera House, Palmerston North)

EVENING

(8.15 p.m.)

State Reception

(Izadium, Palmerston North)

WEDNESDAY, 14 NOVEMBER

MORNING

Section A: Soil Processes and Soil Formation—Weathering

SESSION A1: Clay Formation and Redistribution of Chemical Elements

Chairman: Prof. E. P. Whiteside

Opening Speaker: Prof. G. D. Sherman

Papers:

Weathering and Soil Science *G. D. Sherman*

Laterites in West Africa *R. Hamilton*

Petrographic Studies of Mineral Translocation in Soils
S. B. Hendricks, J. G. Cady, K. W. Flach

Clay Formation in Some Chilean Soils under Natural Forest
Vegetation and under Pasture *L. Léon*

Degree of Leaching as Distinct from Degree of Weathering
and its Implications in Soil Classification and Fertility
J. Papadakis

Experimental Research on the Weathering of Crystalline
Rocks and the Geochemical Characterisation of
Pedogenetic Phenomena *G. Pedro*

Title:

Mineral Composition of Rainwater in Relation to the
Redistribution of Chemical Elements *J. T. Hutton*

WEDNESDAY, 14 NOVEMBER
MORNING (*Contd.*)

SESSION A2: **Nature of the Active Fraction**

Chairman: Dr Sterling B. Hendricks

Opening Speaker: Dr M. Fieldes

Papers:

- The Nature of the Active Fraction of Soils *M. Fieldes*
Surface Areas of Soil Colloids *D. J. Greenland, J. P. Quirk*
The Influence of Inorganic Soil Colloid Surface on Soil
Water Properties *M. Kutilek*
Ion-sieving Phenomena in the Soil *M. Tschapek*
A New Technique for Studying Adsorption on Solid Surfaces
A. T. Wilson, R. J. Furkert

Titles:

- Adsorption Equilibria of Humic Substances
J. H. Grobler, F. W. Pauli
On the Ratio of Cation to Anion Exchange Capacity as an
Index to Characterise Clays
O. T. Rotini, G. Lotti, P. V. Baldacci

WEDNESDAY, 14 NOVEMBER

AFTERNOON

Section A: Soil Process and Soil Fertility—The Nutrient Elements

SESSION A3: Retention by Soils and Release to Plants

Chairman: Prof. G. W. Leeper

Opening Speaker: Prof. Dr A. C. Schuffelen

Papers:

Plant Nutrients in Soils of Different Genesis

A. C. Schuffelen, F. F. R. Koenigs

Principles of Ion Movement through the Soil to the Plant Root

S. A. Barber, J. M. Walker, E. H. Vasey

Some Relationships between Soil Processes and Fertiliser Responses in Chile

E. Letelier, A. C. S. Wright

Diffusion of Phosphates in Soil

D. G. Lewis, J. P. Quirk

Some Nutritional Problems Characteristic of Sandy Soils

P. G. Ozanne

Copper Deficiency in North-west Germany in Relation to Parent Material and Soil Development

E. Schlichting

Soil Selenium and Animal Health

J. H. Watkinson

WEDNESDAY, 14 NOVEMBER
AFTERNOON (*Contd.*)

SESSION A3 (*Contd.*)

Titles:

Balance of Exchangeable Potassium and Total Potassium in
Various Soils *L. Audidier, J. Garaudeaux, H. Chevalier*

Metabolic Control of Ion Uptake by Plants
 S. B. Hendricks, J. E. Leggett, P. C. Jackson

Iron Nutrition in Plants and Supply by Soils
 S. B. Hendricks, J. C. Brown, L. O. Tiffin

The Displacement of Magnesium from Soils *D. E. Hogg*

Relation of Molybdenum Content to Soil Type and Geologic
Formation in Kentucky Soils *H. F. Massey, R. Lowe*

Some Factors Affecting Loss of Ammoniacal Fertilisers
Applied to Egyptian Soils
 M. Y. Shawarbi, M. R. Hamissa

Zinc Deficiency in the Western United States and its Relation-
ship to Soil Properties and Management *F. G. Viets*

Fixation and Availability of Potassium in Loess-derived
and Alluvial Soils *E. Welte, E. A. Niederbudde*

EVENING

(8.15 p.m.)

Public Lecture

(*Opera House*)

Man and the Soil: The Challenge of the Past

Mr Norman H. Taylor

THURSDAY, 15 NOVEMBER

MORNING

Section A: Soil Processes and Soil Fertility—The Nutrient Elements

SESSION A4: **Effect of Micro-organisms on Nutrient Availability**

Chairman: Prof. O. N. Allen

Opening Speaker: Dr R. J. Swaby

Papers:

Effect of Micro-organisms on Nutrient Availability
R. J. Swaby

Losses of Nitrogen Accompanying Nitrification *F. E. Clark*

Bacterial Condition and Nutrient Availability in a Tussock
Grassland Soil under Different Cultural Treatments
K. F. O'Connor, J. B. Robinson, R. H. Jackman

Inorganic Nitrogen Transformation in a Black Earth
G. W. Skyring

Title:

The Influence of Fertilisers on Soil Microflora
A. Malquori, G. Florenzano

THURSDAY, 15 NOVEMBER

MORNING (*Contd.*)

SESSION A5: Biological Factors in Humus Formation

Chairman: Prof. Dr F. Scheffer

Opening Speaker: Prof. Dr M. M. Kononova

Papers:

Biological Factors of Humus Formation *M. M. Kononova*

Estimation of the Time Factor in Soil Organic Matter

Equilibration under Pastures *J. S. Russell*

Chemical Nature, Microbial Resistance, and Origin of Soil
Humus *R. J. Swaby, J. N. Ladd*

Title:

Patterns of Accumulation of Organic Matter in Some New
Zealand Soils under Improved Permanent Pasture

R. H. Jackman

AFTERNOON

Section A: Soil Processes and Soil Fertility—Soil Organic
Matter

**SESSION A6: Biological and Chemical Aspects of
Mineralisation**

Chairman: Dr F. E. Clark

Opening Speaker: Prof. F. E. Broadbent

Papers:

Biological and Chemical Aspects of Mineralisation

F. E. Broadbent

Physico-chemical and Biological Aspects of Podzolisation

D. V. Crawford

Rate of Mineralisation of Organic Matter in Cultivated
Rhodesian Soils

D. H. Saunder, P. M. Grant

THURSDAY, 15 NOVEMBER

AFTERNOON (*Contd.*)

**SESSION A7: Soil Structure—Its Nature and Significance
to Plant Growth**

Chairman: Dr J. P. Quirk

Opening Speaker: Dr T. J. Marshall

Papers:

The Nature, Development, and Significance of Soil Structure
T. J. Marshall

The Effect of Soil Compaction on Root Development
A. C. Trowse, Jr., L. D. Baver

Genesis and Micromorphology of Certain Soil Structural
Types in Hawaiian Latosol and their Significance to
Agricultural Practice
G. Uehara, K. W. Flach, G. D. Sherman

The Influence on Vegetation of Soil Properties as Affected
by a Predominance of Illite
B. Válek

EVENING

(8.15 p.m.)

Civic Reception

(*Concert Chamber*)

FRIDAY, 16 NOVEMBER

MORNING and AFTERNOON

Section B: Soil Classification and Soil Fertility

Chairmen: Dr L. D. Bayer, Mr C. S. Christian

Papers:

Australia

Soil Classification and Mapping in Australia *B. E. Butler*

The Uses of Soil Classification and Mapping in Australia
G. Blackburn

✓ The Factual Classification of Soils and its Use in Soil
Research *K. H. Northcote*

Belgium

Bulgaria

Classification of Soils in the People's Republic of Bulgaria
Z. D. Staikoff, H. Trachliev, T. Bojadjier

Canada

✓ Classification of Canadian Soils *P. C. Stobbe*

✓ The Use of Soil Classification in Agriculture, Forestry, and
Related Fields *W. L. Hutcheon*

Chile

✓ Soil Classification and its Application in Chile *M. Rodriguez*

✓ Environment and Soil Process in the Chilean Sector of the
West Coast of South America

A. C. S. Wright, J. Espinoza

Denmark

✓ Soil Classification and Soil Mapping in Denmark
S. Tovborg Jensen

Egypt

Soils of the Amereya-Maryut Area, Mediterranean Littoral,
United Arab Republic *M. A. Abdel Salam*

FRIDAY, 16 NOVEMBER (*Contd.*)

Eire

Soil Classification and Mapping *Pierce Ryan*

Application of Soil Survey in Related Research Fields
Pierce Ryan

Germany

7 The Soil Classification System of the Federal Republic of
Germany *E. Muckenhausen*

7 The Application of Soil Classification in Agriculture, Forestry,
and Other Fields in the Federal Republic of Germany
A. Beckel

Hungary

Principles of Soil Classification Used in the Preparation of
the Genetic Soil Map of Hungary *P. Stefanovits*

India

Soil Classification as a Guide to the Assessment of Soil
Fertility *S. P. Raychaudhuri*

Israel

Principles of a Proposed Classification for the Soils of Israel
J. Dan, H. Koyumdjisky, D. H. Yaalon

Japan

Genesis and Classification of Humic Allophane Soil in Japan
I. Kanno

Soil Classification as a Basis for Increasing the Productivity
of Agricultural Land *Y. Kamoshita*

New Guinea

The Yellow-brown Soils of the Highlands of New Guinea
G. K. Rutherford

New Zealand

7 Soil Classification in New Zealand *I. J. Pohlen*
7 An Evaluation of the Usefulness of the New Zealand Soil
Classification *R. H. Jackman, C. During,
E. D. Andrews, P. B. Lynch*

FRIDAY, 16 NOVEMBER (*Contd.*)

Norway

Classification and Fertility of Norwegian Forest Soils

J. Lag

Portugal

Soil Classification in Portugal and its Application in Agricultural Research

A. L. Azevedo, J. C. Cardoso

Scotland

✓ The Principal Genetic Soil Groups of Scotland

R. Glentworth

South Africa

✓ Soil Classification and Mapping in the Republic of South Africa

R. F. Loxton

South America

7 Regional Contrast in South American Soil Formation, in Relation to Soil Classification and Soil Fertility

J. Bennema, M. Camargo, A. C. S. Wright

Southern Rhodesia

7 Soil Classification in Southern Rhodesia

R. G. Thomas

Spain

Systems of Soil Classification and Cartography Adopted in Spain

A. Guerra

Soil Fertility Mapping in Spain

V. Hernando

United States

✓ Principles of Soil Classification and Mapping in the United States

W. M. Johnson

Soil Surveys for Use

C. E. Kellogg

U.S.S.R.

① Principles of Soil Classification and Survey in the U.S.S.R.

I. P. Guerassimov

SATURDAY, 17 NOVEMBER

WEEKEND AND LOCAL TOURS

Weekend Tours (see page 19):

- Tour A: Chateau Tongariro
- Tour B: Wellington
- Tour C: West Coast, South Island.

Buses for each of these tours will depart from Massey College at 9 a.m. Arrangements will be made to pick up Members staying at hotels in Palmerston North.

Local Tours (see pages 20-21):

- Tour 1: Full-day tour of Manawatu district.
- Tour 2: Half-day (morning) tour of Lower Manawatu Flood Control Scheme.
- Tour 3: Half-day (afternoon) tour of Te Awa-Pohangina district.

SUNDAY, 18 NOVEMBER

Free day: no formal programme

MONDAY, 19 NOVEMBER

MORNING

Display of Aerial Farming Techniques

AFTERNOON

Section C: Soil Fertility and Land Use

SESSION C12: Problems of Soils of the Humid Tropics

Chairman: Dr A. de Endredy

Opening Speaker: Prof. Dr G. Aubert

Papers:

Observations on Pedological Factors that May Limit the Productivity of Soils of the Humid Tropics *G. Aubert*

Rotation and Fertiliser Studies on Abandoned Kaingin Lands on the Island of Palawan, Philippines

J. G. Davide, L. M. Villegas, E. H. Tyner

Phosphorus Solubility and Availability to Plants and the Aluminium Status of Hawaiian Soils as Influenced by Liming *R. L. Fox, S. K. De Datta, G. D. Sherman*

A Comparison of the Use of Liming Materials on a Hydrol Humic Latosol and on a Humic Ferruginous Latosol in Hawaii *N. H. Monteith, G. D. Sherman*

The Fate of Nitrogenous Fertilisers in a Monsoonal Climate *R. Wetselaar*

Titles:

Land Capability Classification for Regional Planning in Integrated Surveys in Australian New Guinea *H. A. Haantjens*

Podzols and Podzolic Soils in the Lowlands of Sarawak and their Fertility *J. P. Andriessse*

MONDAY, 19 NOVEMBER

AFTERNOON (*Contd.*)

SESSION C13: Problems of Soils of the Paddy Fields

Chairman: Dr S. P. Raychaudhuri

Opening Speaker: Dr H. N. Mukerjee

Papers:

Problems of Soils of the Paddy Fields *H. N. Mukerjee*

A New Classification System of Rice Soils in Japan
I. Kanno

Some Criteria for Evaluating Soil Phosphorus Tests for Low-
land Rice Soils *E. H. Tyner, J. G. Davide*

EVENING

(8.15 p.m.)

Public Lecture

(Opera House)

Man and the Soil: The Challenge of the Future

Dr Charles E. Kellogg

TUESDAY, 20 NOVEMBER

MORNING

Section C: Soil Fertility and Land Use

SESSION C19: **The Use of Chemical Tests as an Aid in Increasing Productivity**

Chairman: Prof. Dr E. Schlichting

Opening Speaker: Dr E. G. Williams

Papers:

Chemical Soil Tests as an Aid to Increased Productivity
E. G. Williams

Soil Analyses as Bases for Fertiliser Recommendations in
Sugar Cane *L. D. Bayer, A. S. Ayres*

The Copper Nutrient Status of Some Soils of the North
Island, New Zealand *W. F. Rolt*

Use of Anion Exchange Resin for Determination of Available
Soil Phosphorus *D. H. Saunder, H. R. Metelerkamp*

Titles:

The Use of Ferrari Chemical Method for Determining the
Available Phosphorus in Italian Soils *C. Ferrari*

The Formulation of a Rational Fertiliser Programme for the
Tussock Grassland Regions of Central Otago, New
Zealand *T. E. Ludecke*

The Residual Value of Applied Phosphorus and Sulphur in
Siliceous Sands in South Australia
K. Powrie, A. C. Jennings

TUESDAY, 20 NOVEMBER

MORNING (*Contd.*)

SESSION C14: Problems of Peat and Other Wet Soils

Chairman: Dr P. C. Stobbe

Opening Speaker: Mr Pierce Ryan

Papers:

Problems of Wet Mineral Soils *E. Quinn, P. Ryan* ✓

Problems of Peatland *W. Burke, P. J. O'Hare* ✓

Agricultural Development of Peat Soils in the Waikato District, New Zealand *F. C. C. Hupkens van der Elst* ✓

Turkey?

AFTERNOON

Section C: Soil Fertility and Land Use

SESSION C15: Problems of Steepland Soils

Chairman: Dr R. Glentworth

Opening Speaker: Mr H. S. Gibbs

Papers:

Problems of Steepland Soils *H. S. Gibbs*

Stability of Steepland Soils of South Island, New Zealand
E. J. B. Cutler

Observations on the Effect of Grazing Animals on Steepland Soils
C. During, Joan E. Radcliffe

Field Experimental Assessment of Fertility in Soils of the High Country of South Island, New Zealand
K. F. O'Connor

Title:

Watershed Management Research and the Steepland Soils, a Practical Problem in Soil Classification

J. T. Holloway, J. Y. Morris, M. J. Wraight

TUESDAY, 20 NOVEMBER
AFTERNOON (*Contd.*)

SESSION C16: **Soil Fertility under a Pasture-animal Regime**

Chairman: Prof. R. Tavernier

Opening Speaker: Prof. T. W. Walker

Papers:

Problems of Soil Fertility in a Grass-animal Regime
T. W. Walker

Extent of Return of Nutrient Elements by Dairy Cattle:
Possible Leaching Losses
E. B. Davies, D. E. Hogg, H. G. Hopewell

Growth Responses of Pastures to Molybdenum Applications
as Related to Soil Classification
C. During

Method of Assessing the Utilisation of Phosphorus on Per-
manent Pastures
J. Karlovsky

Titles:

Assessing the Fertility Status of Soils under Pasture in New
Zealand
P. B. Lynch

Plant Responses to Animal Treading under Different Soil
Conditions
D. B. Edmond

EVENING

Free

WEDNESDAY, 21 NOVEMBER

MORNING

Section C: Soil Fertility and Land Use

SESSION C17: **Methods of Assessing Soil Capability for Crops and Pastures**

Chairman: Dr R. F. Loxton

Opening Speaker: Dr G. W. Cooke

Papers:

Assessing the Capabilities of Soils for Producing Crops

G. W. Cooke

Soil Capability Classification Based on the Genetic Soil Map

E. J. B. Cutler

The Correlation of Soil Classification and Soil Capability
in the Upper Clutha Valley, Otago, New Zealand

M. L. Leamy

The Assessment of Soil Capability for Irrigated Pastures in
the Riverina, N.S.W.

J. Loveday, B. E. Butler

Soil Capability Assessment in the West Indies

I. T. Twyford, J. K. Coulter

Titles:

Soil Surveys, Field Management, and Yield Information as
Bases for a System of Land Productivity Classification
for Hawaii

L. A. Nelson, T. Sahara, F. K. Nunns

WEDNESDAY, 21 NOVEMBER
MORNING (*Contd.*)

SESSION C18: **Methods of Assessing Forest Site Capacity**

Chairman: Mr A. L. Poole

Opening Speaker: Dr P. J. Rennie

Papers:

Methods of Assessing Forest Site Capacity *P. J. Rennie*

Forest Site Mapping in the German Democratic Republic
E. Ehwald, D. Kopp

Response by *Pinus radiata* to Fertiliser Nitrogen and its
Significance in the Maintenance of Forest Soil Fertility
H. D. Waring

Survey of Soils Supporting Forest Plantations in Wisconsin,
U.S.A. *S. A. Wilde, Jaya G. Iyer*

Assessment of Forest Site Capacity in New Zealand
G. M. Will

Forest Soil Science (*Erohina*) *S. V. Zonn*

Titles:

Appraisal of Tree Planting Stock on the Basis of Ordination
Jaya G. Iyer

Humus, Forest Capacity, and Forest Site Mapping
G. Manil

AFTERNOON

Free

EVENING

Reception

(*Exhibition Hall*)

THURSDAY, 22 NOVEMBER

MORNING

Session on World Soil Maps

Business Meetings: Commission IV
Commission V

AFTERNOON

Section D: Soil Science and Society

Chairman: Dr Charles E. Kellogg

Papers:

The Development of a Soil from an Industrial Waste Ash

~~F. Cope~~

Application of Knowledge on Soil-forming Processes for
Reclamation of Industrial Waste-lands

~~J. Semotán~~

1. Soil Science and Society 20' P. G. Aderiken

(3) Society, Town Planning, and the Soil Map 15' J. D. Raeside

(4) Soils and Human Health with Particular Reference to Dental
Health

~~Dr. Darius~~ F. L. Losee

(6) Dental Caries Prevalence in Specific Soil Areas at Napier
and Hastings

~~Dr. T. G. Ludwig~~ W. B. Healy, R. S. Malthus

(5) Prevalence of Dental Caries in Relation to New Zealand
Soils

P. B. Cadell

(2) National and International Soil Resources Maps 15'

A. P. A. Vink, H. S. Gibbs

(8) Soil radioactivity and health

~~Dr. Marsden~~

(7) Cancer and discrimination and soil

EVENING

Free

in new Zealand.
~~Dr. Robert Williams~~

Schaffer
Albert
Taylor

SOILS EXHIBITION

Wool Room, Massey College

This exhibition is intended to show the visitor a broad outline of the soils of New Zealand, their uses, and their problems. More detailed information on any of the material shown can be obtained from the Information Desk at the entrance. The layout of the Exhibition is shown on the diagram opposite.

- | | |
|---------------------------------------|------------------------------------|
| 1. Information desk | 13. Soils and animals |
| 2. Geographic features of New Zealand | 14. Soils and pasture |
| 3. Maori soils | 15. Soils and animal health |
| 4. New Zealand soils | 16. Land utilisation |
| 5. Clay mineralogy | 17. Hill-country utilisation |
| 6. New Zealand plants and shrubs | 18. Soil engineering |
| 7. Soil biology | 19. Soils and town planning |
| 8. Organic matter | 20. Soil corrosion |
| 9. Irrigation and drainage | 21. Soils and dental caries |
| 10. Soil physics | 22. Soils and forestry of Westland |
| 11. Soil structure | 23. World soil profiles and maps |
| 12. Soils and grassgrub | |

A short legend of New Zealand soils is given on page 48.

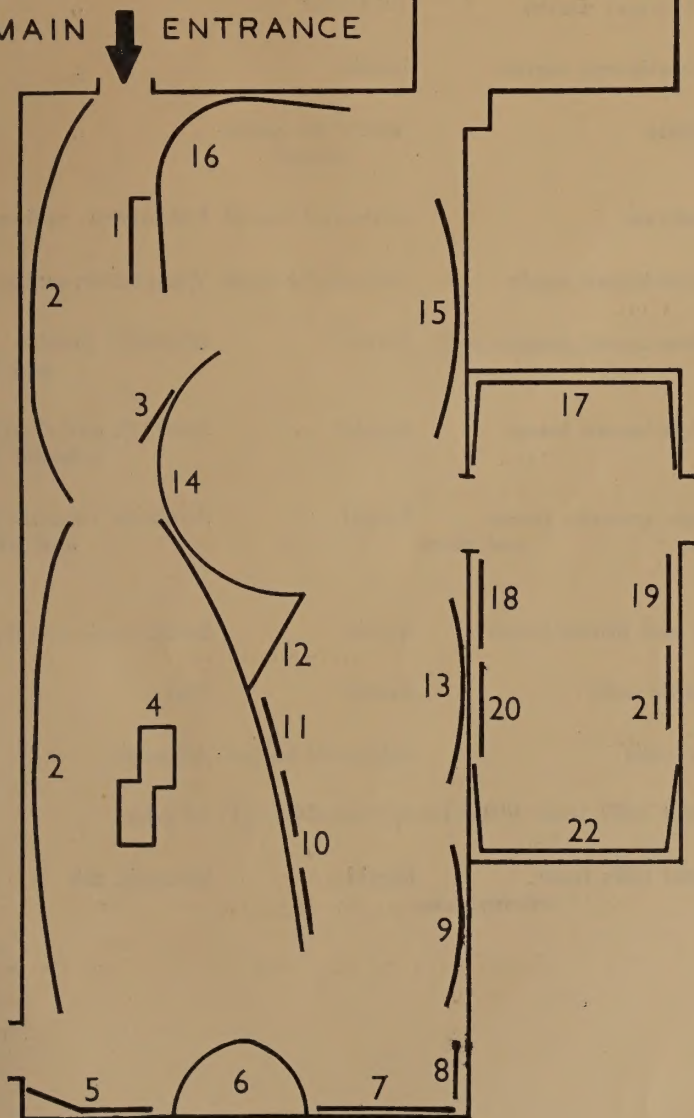
Acknowledgments

The young trees used for decoration have been supplied by the New Zealand Forest Service.

This exhibition has been made possible by the co-operation and help of many members of the staffs of: Massey College and Lincoln College; the Departments of Agriculture, Scientific and Industrial Research, and Tourist and Publicity; the Fertiliser Manufacturers' Research Association; the New Zealand Forest Service; the Soil Conservation and Rivers Control Council; and the Town and Country Planning Branch of Ministry of Works.

Soils Exhibition
WOOL ROOM
MASSEY COLLEGE

MAIN ENTRANCE



SHORT LEGEND OF NEW ZEALAND SOILS

Brown-grey earths	semiarid	Non-calcareous sedimentary and metamorphic rocks
Yellow-grey earths	subhumid	"
Yellow-brown earths	humid	"
Podzols	humid to super-humid	"
Rendzinas	subhumid-humid	Calcareous sediments
Yellow-brown sands	subhumid-humid	Wind-blown sands
Yellow-brown pumice soils	humid	Rhyolitic pumice and ash
Yellow-brown loams	humid	Andesitic and rhyolitic volcanic ash
Brown granular loams and clays	humid	Andesitic volcanic ash and rocks
Red and Brown loams	humid	Basalt scoria and flows
Organic soils	humid	Peat
Gley soils	subhumid-humid	Alluvium
Recent soils from alluvium	subhumid-humid	Alluvium
Recent soils from volcanic ash	humid	Volcanic ash





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INTERNATIONAL SOCIETY OF SOIL SCIENCE
JOINT MEETING OF COMMISSIONS IV & V



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Dr B. Meyer	Prof. E. Welte

GHANA

Dr A. S. de Endredy*

* Not attending

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Dr Jaya G. Iyer

INDONESIA

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Prof. N. K. Krupskij

VENEZUELA

Mr L. Roca

VIETNAM

Nguyen Thi Tam

November 14: I am up at 6:45. Then tea, a short stroll, and breakfast. Our first session starts at 9:00 a.m.

For the meetings we have advanced reprints or page proofs of each paper to read in advance. These are summarized by the authors, if present. Debates are written out on cards and taken by tape recorders. The whole is to be published. Thus these notes make no attempt at detailed summaries.

Sherman of Hawaii begins.

During the discussion I speak briefly on the importance of water and temperature as soil properties to use in soil classification in contrast to "climatic belts" outside the soil. Certainly it is difficult to determine these properties of soil, especially in mapping. But they cannot be ignored. They are highly important parts of the morphology and are important to both genesis and behavior in natural and cultural environments.

After tea we go back to the A2 session with quite a bit of discussion on soil surfaces and their effects on the retention of ions, including plant nutrients.

We are told that under a vigorous pasture on soils that hold K poorly - such as the yellow-brown loam, one gets luxury consumption of the added K. The animals graze widely but excrete the K in spots so that within three months K deficiency appears outside of these spots. Allophane absorbs little K.

After this session we go to lunch. A young lady brings me my corrected ticket.

Norman Taylor asks me to explain to Aubert that his introduction this evening should be very brief.

At 2:00 p.m. we go to session A3.

Professor Schuffelen says that magnesium deficiency is greater in wet springs than in dry springs. And also he says that primary and perhaps secondary minerals are more important K sources than exchangeable K.

Barber says that mass flow accounts for most of the Ca and Mg entrance into plants; while diffusion is most important for K and P.

It is said that in both Australia and New Zealand cobalt gives a response on nodulated clover and lucerne, but not on plants that are not nodulated or if nitrogen fertilizer is used.

In the discussion it was brought out that copper seems to be held in unavailable forms. Some say that the chelates are responsible; while others suggest other kinds of complexes. Some say that in the Podzol copper is concentrated in the upper raw humus.

It is said that most Se in the soil is in the form of Selenite on iron oxide. Thus total Se correlates fairly well with the effects on sheep.

After the session I have a long interview with a reporter. And then another with Dr. A. Finck of Germany who wants material on the fertility of tropical soils.

We have a nice dinner at Massey College and then go to the opera house again for a public lecture by Norman Taylor. He is his normal self.

Late to bed at 11:00.

November 15: I am not up until 7:30. Tea with Norman, breakfast, and to session A4 at 9:00.

The soil microbiologists seem negative to me. I speak briefly of their great challenge to find out how so much nitrogen is fixed within certain soils of the tropics and subtropics - great nitrogen fixation that actually takes place by some means. The current nitrogen cycle diagrams simply miss something very important. If we could find out how this works we would be in a position to improve our management for greater nitrogen supplies in the newly developing countries.

It is said that in the long leys of New Zealand, the increases of nitrogen, carbon, and phosphorous are in the upper three inches.

We go to lunch. My first letter from Mommy at Palmerston North reports snow in Washington on November 5.

After lunch we are back for sessions A6 and A7.

Both of these are a bit on the dull side.

I am given a nice set of New Zealand transparencies; then dinner, and into the buses for another reception in the city. Dr. and Mrs. Fieldes bring me back about 9:45, for which I am very grateful.

To bed at 10:20.

November 16: Up at 6:30, tea, breakfast, and to section B. We really have many too many papers for this day. First we have T. P. Gerasimov of the USSR. He gives us the classical Russian system and explains something of the interpretive maps made from detailed soil maps of farms. Curiously he speaks of the "unified Soviet system of soil classification."

Muckenhausen has been influenced too much by Kubiena but this influence has been modified recently by Tavernier.

W. L. Hutcheon has an interesting paper. Glentworth and Stobbe are as usual. William Johnson gives his good paper well.

R. Marechal gives both Belgian papers well.

Loxton of South Africa seems to be quite good although I don't recall hearing him before. He says that with some modifications they have found the Seventh Approximation very useful in South Africa. (He has studied it more than any of the others except the Belgians.)

Thomas of Southern Rhodesia tells about their early failures from trying to develop the higher categories so that after the War they concentrated on cataloguing the soils. He thinks now the legend worked out by the CCTA under the leadership of D'Hoore will be useful if the definitions can be more precise.

Northcote amuses me and irritates me by his so-called "factual" classification. He is as subjective as any and more than most in the selection of his criteria.

After lunch Pohlen of New Zealand presents a scheme worked out by Norman Taylor. At least he convinces me that we in the United States need more work on soil biology - bacteria, fungi, and small animals (especially termites and earthworms) - specifically related to the taxonomic units.

Some other papers are given and we have a rather wild discussion interrupted by tea.

Later Butler of Australia attempts a summary and emphasizes the greater need as he sees it for coordination between classification and genesis.

I give the last paper with special reference to the balance between basic science and application in a going soil survey program. At the end there is a rambling general discussion that leads nowhere. It lacks rigor. Although the whole proceeding is in English many of the participants lack an understanding of what the words mean.

After the session I go to the library for an interview on tape for the national radio.

After dinner I meet Mme. Erohina who had just arrived after an unpleasant trip from Moscow. Because of errors in her reservations she was long delayed in two places. She is extremely tired.

After a little chit chat with Sterling Hendricks and Norman Taylor I am early to bed.

B

INTERNATIONAL SOIL CONFERENCE
NEW ZEALAND
1962



Transactions

COMMISSION IV (Soil Fertility and Plant Nutrition) and
COMMISSION V (Soil Genesis, Classification, and Cartography),

INTERNATIONAL SOCIETY OF SOIL SCIENCE

SOIL SURVEYS FOR USE

By

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SOIL SURVEYS FOR USE

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Soil surveys are essential to orderly land development. Scientific data and technical experience are especially scanty in the tropics and sub-tropics. Only the uninformed or the reckless can encourage cultivators to adopt new combinations of practices without soil surveys and field testing on representative areas of the kinds of soils that can be used. We in soil science know this. We have all seen the great wastes from planning without soil surveys. We are commonly called in for the post-mortems of both big and little schemes planned without them. Some of these failures trouble us; but some have helped us. I am persuaded that the failure of the British Groundnut Scheme in East Africa did more to get soil surveys accelerated in that continent than anything else.

We are here mainly to discuss our experiences, I take it, both our successes and our difficulties. Most of us have had both. Over the years my greatest problem has been one of balance, balance between the strictly scientific study and classification of the soils and the interpretation of their potential behaviour under defined use or manipulation. A balance can of course be had with a low level of excellence of each; but I shall argue for balance at a high level.

To begin negatively, over the years we have had two highly articulate kinds of criticism: (1) The Soil Survey should be a strictly scientific institution. The application of its work in terms of crop adaptation, yields, and practices is a technical matter for others, not for scientists. By stressing these applications, the scientific effort is diluted and the soil survey downgraded to a "service" programme. (2) Others say that they need practical soil surveys for practical purposes without all this scientific jargon about soil profiles, Chernozems, Vertisols, and all the rest.

If our experiences have shown anything, they show clearly that we cannot have dependable soil surveys of firm prediction value without a sound scientific basis. Soil surveys have become increasingly useful and precise as this scientific basis has deepened and broadened. At the same time the avowed purpose of soil surveys is to furnish a basis for suggesting the alternative uses to which the kinds of soil shown on the map can be put, and for predicting their expected behaviour under the reasonable alternatives for management or manipulation for each use.

Our financial support has come from people who were persuaded that soil surveys could improve the efficiency of land use. We have an obligation to see that they do.

Some argue that other people can do the interpretation. Looking at the record, I do not believe others will do much. Specialists in agronomy, horticulture, forestry, range, economics, engineering, and the like can help us. But they cannot be expected to know enough about soils to appreciate more than a few of the obvious properties that influence their behaviour. The soil scientist must make the interpretation, in the first instance, from the data he can get from other specialists and from his own observations. Then others can react to his drafts. They can study the comparisons, can criticise, and can help him improve the interpretations.

We must continually recall that the soil scientist is the only one in the whole scientific fraternity whose work demands attention to ALL the alternative uses, including field crops, horticulture, grass, forest trees, and foundations for roads and buildings, as well as many others. He alone is concerned with all of these, and with the stability of the soil—the hazards of slips, erosion, or blowing—and the potential responses on a sustained basis at different levels of management, through combinations of both drastic and simple practices for modifying the soil.

We have been working on the basic properties of soils and on the classification of soils for a long time. In the early years less effort went into the interpretation of the classification and the maps. Interpretations are somewhat ephemeral. They change with changes in the agricultural arts and with economic conditions. Then, too, people need many kinds of interpretations, for both general and specific purposes. The needs vary considerably from place to place. Many making the early interpretations were satisfied with simple qualitative comparisons that group soils under such terms as “good”, “fair”, and “poor”. So long as our classification and mapping were still rather crude, it was difficult to do more. Yet we have gone a long way in both classification and in the technique of mapping. Both farmers and research stations have gathered an enormous amount of data and experience. We no longer have valid excuses for rough qualitative interpretations; nor will these suffice in a truly modern agriculture with its great investments. Now engineering interpretations are being made and widely used. Even greater investments per acre or per hectare are involved. And good results demand a higher precision.

Maintaining a proper balance between the scientific work and its interpretation requires continual readjustments in all aspects of a soil survey programme. As the Queen told Alice, “here . . . it takes all the running you can do to keep in the same place.”

The methods of soil research are continually improving. More and more properties can be measured; new methods are coming along to permit greater speed of measurement, greater accuracy, or both. More kinds of soil are being investigated. Since our basic, scientific soil classification depends on what we know, and needs to include what we know, the system must be continually re-examined and revised if we are to reach our objectives.

For a long time soil science will doubtless remain a highly descriptive science as compared, say, to physical chemistry. Yet, as we can, we must make every effort to quantify our science, to put our results in mathematical terms—and to develop more general and more precise principles. But, at best, the system is somewhat arbitrary in many places. Classes of soil slope, soil depth, and many other properties have more or less arbitrary limits. Where a firm scientific principle is lacking to fix a specific limit, we should be guided by the needs for interpretation. To take a simple example among dozens, rarely is a strictly scientific reason available for setting slope phases at 3, 4, 5, or any other percentage figure. Based on empirical evidence, we should choose the limits for each kind of soil that result in individual units of the greatest value for prediction.

Thus we have important interactions between the basic classification and the interpretations we derive from it. Each serves as a test of the other. If the interpretations fail to fit reality, something is wrong with the system of classification, or the scheme for interpretation, or both. Changes in one may call for changes in the other. **BUT NEVER SHOULD THEY BE MIXED.** In the basic soil classification we must stick to soil characteristics. These, and degrees of their expression, are given weight according to what we know to be the relationships among sets of soil characteristics from our studies of soil genesis and behaviour. But both genesis and behaviour must be kept one step removed from the classification itself.

This principle is of the utmost importance. Where either genesis or behaviour, by itself, has entered directly into the scheme of classification of units intended to carry predictions, rather than soil properties, the number of interpretations that can be made from the resulting soil survey are severely limited and reinterpretation for new purposes becomes impossible.

We also have had great improvements in sampling and mapping techniques and in cartographic methods during my years as a soil scientist. Aerial photographs of high quality make excellent bases for field mapping. By examining overlapping pairs with the stereoscope we can plan the work ahead much better, especially in wild country. For a given standard of accuracy low-intensity soil surveys can be made in much less time than formerly. (We must not overlook the fact, however, that some have gone much too far with reconnaissance

or low-intensity soil surveys, so called, with aerial photographs alone, and without making the essential soil examinations.)

The use of photographs permits more accurate plotting of soil boundaries. Easily read copies of field sheets can be made available in advance of publication. Soil maps compiled on controlled mosaics have several advantages, especially for detailed soil maps, because of the large amount of local control to help the user. The accuracy with which the map user can locate himself by prominent features that he can see both on the map and on the ground determines the detail he can read from a soil map, and hence its usefulness to him. Several types of cameras and other machines have improved the process of compilation of soil maps in the cartographic laboratory. Modern soil maps are more accurate, more easily read, and more easily reproduced than formerly, and yet are reasonable in cost.

Above all, we must adjust our work to meet the problems of our users. Many have asked me: "When will you cease changing the names and definitions of soils?" I have a pat answer: "When we stop learning about soils and when people have no new problems of soil use and management." As new kinds of problems arise that can be solved only with the help of soil information, we must do our best to organise what we know in forms that the user can understand and, ultimately, in terms that are familiar to him. Something prepared only for our own convenience may not be the most helpful to the user.

Modern agriculture is becoming more complex. It makes increasing use of indirect labour in the form of chemicals and machines. It is becoming more efficient and more competitive. Generally highly skilled managers receive increasingly higher rewards, and poor managers have declining returns.

We are less and less concerned with how a soil responds to simple management. One still hears the term "inherent productivity." If one tries to get at this quality, the more he studies and works for it the slipperier it gets. If he really works hard to grasp it, the concept slips away entirely. Soil productivity results from a coordination of soil and management, not from either alone. When I look at a soil—any soil—I think less and less of what can be done with it the way it is, but more and more of what can be made out of it. The farmer makes his arable soil from either a natural or an old arable soil. All arable soils are changed from the natural soils; some a little, many a great deal. A large part of our most productive soils has been drastically changed with big machines to increase depth or for shaping the surface, with practices to control water, or with lime, fertilisers, and other amendments.

Each new combination of practices changes our interpretations or at least requires new ones. Some soils respond to the new combinations and others do not. Not only are the absolute potentials of soils altered

with changes in the agricultural arts, but also their relative potentials. Some soils formerly regarded as good for cropping are shifting into other uses; and other soils formerly not suited to crops are being made into highly productive arable soils. Thus a soil survey made with a good classification based wholly on properties, and with accurate boundaries, can be interpreted and reinterpreted for users over a long period ahead.

In a short paper it is not possible to lay out the methods in current use for the many kinds of soil survey interpretations that must be made in an active soil survey programme. Most are described in the literature of soil science of the past two decades.

For many interpretations in agriculture one starts with the yield-and-practice table. For each kind of soil under each important alternative set of practices, we need to have estimates of the yields of the adapted crops and the effects of the sets of practices on long-time soil productivity. Similar basic material is used in forestry and range. For occasional purposes one needs to pull out some one soil characteristic or quality for highlighting. Soil slope, stoniness, erosion hazard, and soil depth are examples. This kind of thing is fairly easily done, but it has limited usefulness. We need synthesis rather than analysis. Reliable predictions depend on synthesis.

Here I shall attempt to stress only a few of the general principles abstracted from our experience:

1. Soil survey interpretations are predictions of soil behaviour under stated conditions of management or manipulation. They are not recommendations. Production takes place within individual tracts of land, and these tracts have characteristics, especially economic ones, besides soil that affect recommendations.

2. Soil survey interpretations can be presented in tabular form for each individual taxonomic unit shown in the soil survey. For a good job this must be done anyway. With this done, one may group soils into 3, 5, 7, 9, or some other odd number of groups, depending upon the detail needed. (With odd numbers, one always has a clear "middle" and the two ends.) Such groupings are most easily done where the purpose is specific. In fact, where specificity is required it is best to have a unique grouping for each defined purpose rather than a broad grouping for several purposes. If the broad grouping has only a few classes, it is likely to lack specificity for any one purpose. If it is complex enough to serve several objectives, it has no advantage over the basic soil classification with interpretations in tabular form.

We must continually recall that whenever we group two kinds of soil some specificity is lost. But with a narrow, clearly defined objective, complexity can be greatly reduced with only a small loss of specificity.

3. The soil scientist must be highly resourceful in gathering and writing down data from several sources: farm, ranch, and plantation records, where production records have been kept by fields; results of field experiments laid out on kinds of soil; field sampling of crops on known soils, and so on. Such work needs to be scheduled as a regular part of the field procedure during the course of the surveys, not left to the end. Trial interpretations are needed as tests of the preliminary classification and mapping legends.

The soil scientist must be careful not to confuse soil taxonomic units and mapping units. Where mapping units necessarily contain contrasting inclusions, or are complexes of contrasting soils, ratings of taxonomic units cannot be equated directly with mapping units.

4. Efforts should be made to establish as long in advance as possible what we have called "benchmark" soils—typical examples of prominent kinds of soil over the whole range of conditions—and the significant uses of each for crops, grasses, or trees. It is better to have full field and laboratory studies, including field experiments, on a few key kinds of soil than scattered data from many kinds. The data from these can be organised to bring important interactions into focus.

Experience shows that qualified soil scientists can make a good array of soils from the highest to the lowest according to many interpretations. But to quantify the array with specific figures for estimates, a few quantitative benchmarks are needed over the whole array. That is, if one has 125 taxonomic units in a detailed soil survey, one may commonly quantify an array quite well with reliable data from six to 12 prominent taxonomic units within the array. This principle applies in nearly all interpretations, including those for forestry and for engineering properties.

5. Actually the soil scientist never has all the data he should like and many of his estimates are arrived at by a synthesis of two separate approaches: by induction from his knowledge of soil properties and by deduction from experience and empirical research. I suppose that if we knew enough about soils, about the interactions among soil properties, and about the interactions between sets of soil properties and sets of management practices, we could arrive at sound estimates of adapted crops and yields on a soil new to us without ever having seen or heard of the crops having been grown on that soil. We know, better than anyone else, the limitations of this process. But still it is a useful process of reasoning to go through. On the other hand, we can determine from empirical observation that a certain kind of soil responds to practices in a certain way without knowing the reasons why it responds. This process, too, has limitations. If we do not know the factors involved, some unusual one may have been introduced without our realising it. Thus with the knowledge of soils

that we have gained with experience and from the literature, we reason inductively to a prediction; and from our observations in the field we reason deductively to a prediction. Then we need to compromise the predictions from the two approaches to a synthesis that seems reasonable from both points of view.

6. Perhaps the most important step to be taken in soil survey interpretations (one that is often omitted) is careful planning of exactly what we want a given set of interpretations to show. The more quantitative we can make it, the greater its value to our users. Soils grouped generally according to their productivity for crop plants without specifying the crops or the management systems are of little use to anyone. Unhappily, the literature is fairly full of such kinds of interpretations, apparently made in response to the vague feeling that interpretations are expected rather than in response to the specific needs of the users of the soil maps. Planning good soil survey interpretations, like planning good research, depends first of all on a clear statement of the critical questions.

7. It is highly important to distinguish clearly between soil survey interpretations and land classification. We can make specific predictions about the potentials of kinds of soil to behave in certain ways under specific sets of assumptions. These are not recommendations. Land, however, is real estate. It is the area within which production takes place. Each individual tract of land has a unique latitude and longitude. A proper land classification is a classification of these tracts of land, or potential tracts, as used by firms. Besides soils land tracts have important characteristics of size and location that affect their potential uses and their value. With good soil survey interpretations, soil scientists have made excellent land classifications. In doing so, of course, they took regular account of all other characteristics of land and how they interact with soil resources, to arrive at specific values, index numbers, or other quantitative units.

November 17: After breakfast most conference members leave on various week end tours. I remain to assemble my notes and to make a final draft of my public lecture, which comes up next week.

Later I go over to look at the fine Soils Exhibition. (See folder for the 23 departments of it.)

It is explained that last year 650,000 tons of super-phosphate were spread by air, mostly on soils that are too steep for treatment with ordinary methods. The fertilizer exhibit indicates substantial increases in the use of cobalt-super mixtures, molybdenum-super mixtures, and DDT-super mixtures. Also there were substantial increases in the use of sulphur, lime, and selenium.

They have a very interesting exhibit on the corrosion of metals in different kinds of soil.

An exhibit on the relation of soils and grazing animals shows quantitatively the bad effects of treading, especially when the soils are wet. Some growers use a "sacrifice paddock" for the animals during wet periods in order to avoid damage to the others. Then the next year this paddock is worked up for a crop such as potatoes or swedes.

An interesting exhibit shows how the inevitable hillside tracks on steep soils leads to exceedingly uneven distribution of fertilizer.

INTERNATIONAL SOCIETY OF SOIL SCIENCE
JOINT MEETING OF COMMISSIONS IV & V



**SOILS
EXHIBITION**

SHOWING IN THE WOOL ROOM, MASSEY COLLEGE,
PALMERSTON NORTH, NEW ZEALAND,
13—22 NOVEMBER, 1962.

The Exhibition will be open to the Public from 2 p.m. to 5 p.m. on
Saturday, 17 November, and to parties by arrangement with the
Secretariat, International Soil Conference, Massey College.

SOILS EXHIBITION

Wool Room, Massey College

This exhibition is intended to show the visitor a broad outline of the soils of New Zealand, their uses, and their problems. More detailed information on any of the material shown can be obtained from the Information Desk at the entrance. The layout of the Exhibition is shown on the diagram opposite.

- | | |
|---------------------------------------|------------------------------------|
| 1. Information desk | 13. Soils and animals |
| 2. Geographic features of New Zealand | 14. Soils and pasture |
| 3. Maori soils | 15. Soils and animal health |
| 4. New Zealand soils | 16. Land utilisation |
| 5. Clay mineralogy | 17. Hill-country utilisation |
| 6. New Zealand plants and shrubs | 18. Soil engineering |
| 7. Soil biology | 19. Soils and town planning |
| 8. Organic matter | 20. Soil corrosion |
| 9. Irrigation and drainage | 21. Soils and dental caries |
| 10. Soil physics | 22. Soils and forestry of Westland |
| 11. Soil structure | 23. World soil profiles and maps |
| 12. Soils and grassgrub | |

A short legend of New Zealand soils is given on page 48.

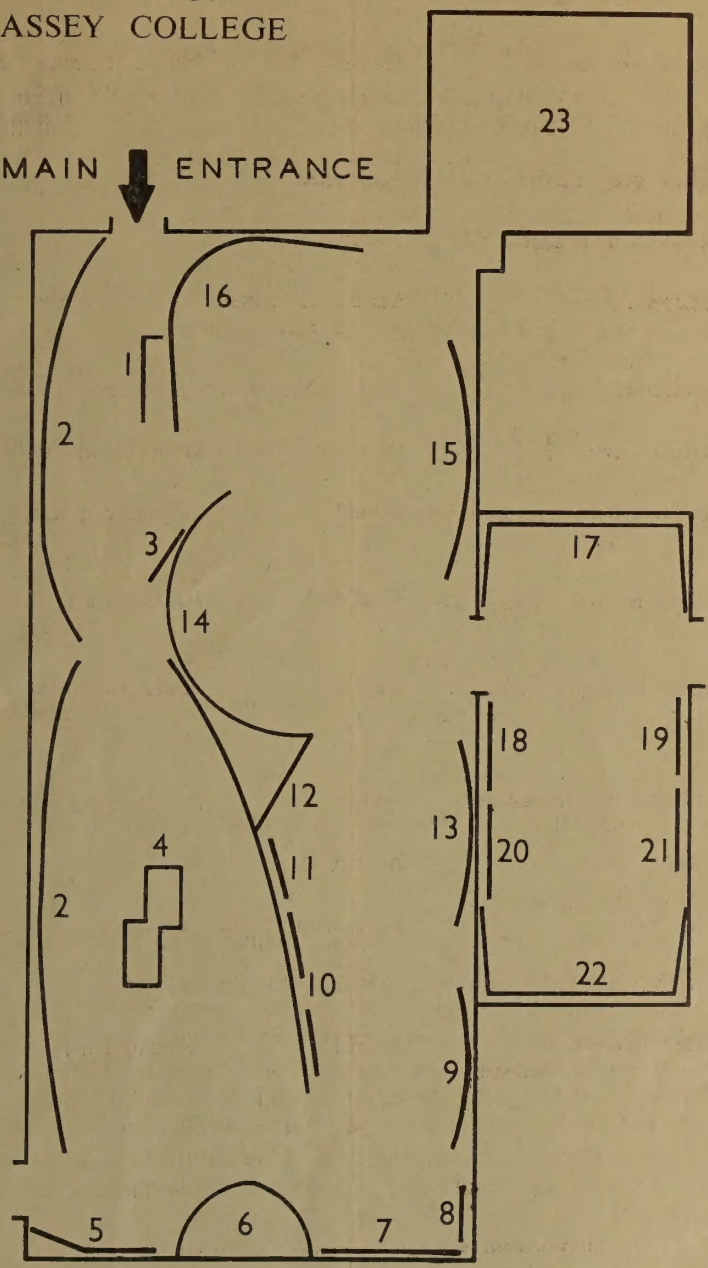
Acknowledgments

The young trees used for decoration have been supplied by the New Zealand Forest Service.

This exhibition has been made possible by the co-operation and help of many members of the staffs of: Massey College and Lincoln College; the Departments of Agriculture, Scientific and Industrial Research, and Tourist and Publicity; the Fertiliser Manufacturers' Research Association; the New Zealand Forest Service; the Soil Conservation and Rivers Control Council; and the Town and Country Planning Branch of Ministry of Works.

Soils Exhibition
WOOL ROOM
MASSEY COLLEGE

MAIN ENTRANCE



SHORT LEGEND OF NEW ZEALAND SOILS

Brown-grey earths	semiarid	Non-calcareous sedimentary and metamorphic rocks
Yellow-grey earths	subhumid	"
Yellow-brown earths	humid	"
Podzols	humid to super-humid	"
Rendzinas	subhumid-humid	Calcareous sediments
Yellow-brown sands	subhumid-humid	Wind-blown sands
Yellow-brown pumice soils	humid	Rhyolitic pumice and ash
Yellow-brown loams	humid	Andesitic and rhyolitic volcanic ash
Brown granular loams and clays	humid	Andesitic volcanic ash and rocks
Red and Brown loams	humid	Basalt scoria and flows
Organic soils	humid	Peat
Gley soils	subhumid-humid	Alluvium
Recent soils from alluvium	subhumid-humid	Alluvium
Recent soils from volcanic ash	humid	Volcanic ash



AGRICULTURAL AIR AID

- BUILDING SOIL FERTILITY with Aircraft -

D.A. Campbell.

SOIL FERTILITY COMMISSION. SPECIAL SESSION 8pm November 20, 1962.

INTERNATIONAL SOIL SCIENCE CONFERENCE
PALMERSTON NORTH,
NEW ZEALAND.

LOCATION OF 20 FARMS INVESTIGATED AND SOIL CONSERVATION RESERVES



Locations of Farms Investigated and Soil Conservation Reserves cited.

AGRICULTURAL AIR AID

- BUILDING SOIL FERTILITY WITH AIRCRAFT

INTRODUCTION

Aerial Farming is the most dynamic agricultural movement of our times, because along with good management, it activates a soil fertility building spiral to accelerate the growth of erosion-resistant, flood-controlling and more productive pastures, to lay the foundations of a conservation farming system suited to the needs and capabilities of the hill and mountains lands.

PROBLEMS TACKLED

The overwhelming hill country problems of depletion of fertility deterioration of native and sown pastures, reversion to scrub, fern and weeds, explosive spread of rabbits, deer, goats and opossums, excessive burning and grazing and consequent alarming severity of soil erosion and flooding - a legacy of the first century of pioneering in New Zealand - seemed insurmountable.

In the depressed 1930's we were fast losing the empire of grassland won by pioneer farmers.

INVESTIGATORS AND LEGISLATORS

These challenging problems created the need for a new kind of pioneers in the second century of farming - scientists and legislators. Soils were investigated to reveal mineral and other limitations, topdressing requirements and potential production (1). The extent and severity of deterioration was reported on by a Commission of Inquiry (2). Soil Erosion and flooding was investigated when the Soil Conservation and Rivers Control Act (1941) became law (3) and a big impetus was given to tackling hill soil problems (4). Burning became subject to permit under the above Act and the subsequent Forest and Rural Fires Act (1948). A successful killer and decommercialisation was vigorously prosecuted when the Rabbit Destruction Act was passed in 1948. The noxious Animal Act 1945 led to organised destruction of deer, goats, opossums, chamois and thar. The Marginal Lands Act 1948 provided financial assistance for the development of hill country. The provisions of the Land Settlement Act resulted in the mass production of farms for soldier settlement after the war.

BIRTH OF AERIAL FARMING

During the course of developing soil conservation practices on several hill country farms the necessary protective and productive pastures could only be obtained by improved management after raising fertility levels by topdressing and oversowing.

As the necessary wholesale distribution of phosphate was impractical with existing methods, alternatives were investigated.

Because of the dual harvest likely to accrue - enhanced production and increased protection against soil erosion and flooding - the Soil Conservation Council resolved in 1947 to organise and finance the original aerial topdressing and seeding trials and demonstrations (5).

The first flying topdressing ushered in the new era of mechanisation of hill country farming thereby making a positive fertility building programme practical on depleted hill soils. The enthusiasm engendered by the 1,000 acre demonstration of an aerial farming service among farmers and would-be operators alike gave Agricultural Aviation a flying start. Armed with this information, ex-service pilots rapidly developed the Agricultural Aviation Industry to engage in a new war against exhaustion of hill soils, deterioration and soil erosion. (6) The aerial topdressing fleet rapidly grew to one of over 300 Tiger Moths which were acquired cheaply and did yeoman service until they were gradually replaced by heavier modern machines. In 13 years the Industry has grown to one of 59 operators employing 719 skilled staff in using 247 aircraft and equipment worth upwards of £3 million.

RESULTS OF AERIAL FARMING ON PROGRESSIVE FARMS

As the most practical way of evaluating the contribution being made by aerial farming is on typical farms, a questionnaire was circulated through operators in the Aviation Industry to their progressive clients (7)

Records of performance since they commenced aerial farming, on each of 20 medium sized hill country farms in 15 counties are summarised in Table I.

TABLE I

AVERAGE AREA. TREATMENT. CARRYING
CAPACITY AND PRODUCTION OF
20 HILL COUNTRY FARMS

Details

Area of Farm	2400 acres
Area topdressed	1706
Phosphate used	875 tons or 10.2 cwt per acre
Lime used	233 " " 2.4 " " "
Clover seed used	2.1 " " 2 lbs " "
Additional Fencing	237 chains or .14 chains per acre

<u>Carrying Capacity</u>		<u>Before</u>	<u>After</u>	<u>Increase</u>
Sheep	{ Ewes	1156	2430	2 fold
	{ Others	600	1660	2.7 "
Cattle	{ Breeding Cows	65	162	2.5 "
	{ Other	80	254	3.1 "
Sheep Equivalents		2481	6170	2.5 "

<u>Production</u>	<u>Before</u>	<u>After</u>	<u>Increase</u>
Wool (bales)	42	125	3 fold
Fat lambs	356	1289	3.6 "
Fat Cattle	13	70	5.3 "
Store Cattle	45	113	2.5 "

DISCUSSION

The average area is above the New Zealand average. The low proportion of ploughable land on these farms is typical. Since the 10 cwt of phosphate per acre used for 9 years (average 1.17 cwt per acre per annum) is little more than the normal threshold requirement of so much land, there appears to be considerable latitude for further increases in production of these farms.

The average application of 2.4 cwt of lime per acre over the period is surprisingly high, while the clover seed used is in line with general practice. The additional fencing of .14 chains per acre is low in comparison with the recognised requirement of approximately one chain per acre when a changeover to intensive farming is made. Ewe carrying capacity has been doubled, while that of other sheep has been increased 2.7 times, indicative of the marked trend on some farms to increase dry sheep. The pronounced trend to use a greater proportion of cattle - possibly to save labour and improve pasture management - as indicated by the 2.5 fold increase in breeding cows and 3.1 fold increase in other cattle. The threefold increase in wool, the 3.6 fold increase in fat lamb and the fivefold increase in fat cattle are the most striking results of the topdressing and improved farm management programmes on these farms. If production is an index of soil fertility, the fertility levels of these soils have been raised 2.5 fold.

RESPONSE OF HILL COUNTRY SOILS

As farms on hill country comprise gently sloping, rolling and steep land in varying proportions the farms chosen were selected from those which did not have more than 25% ploughable land.

SOIL TYPE. TOPDRESSING AND CARRYING
CAPACITY (in sheep equivalents)

		Lime in cwt per acre	Phosphate in cwt per ac. per year.	No of years	Sheep equivalents carried per ac.	Est. Potential ewes/acre 1954
1 Otematea		1.3	1.2	10	3.3	2
2 Rodney	Whangapiro 34,34H	.27	2.7	9	5.3	2
3 Waikato	Mangatawhiri fine sandy loam	2.6	2.5	4	6.2	2
4 Ohinemuri	Komata 8% H Arohoa 130a clay loams		2	11	6.7	2.2
5 Waipa	Ohaupo 59aH Silt loam		2	8	6	3
6 Rotorua	Kaharoa 17 medium sand		3	10	6.6	3
7 Rotorua	Ngaroma 19 & 19H sandy silt		1.2	8	4.5	4.2
8 Rotorua	Taupo 18aH sandy silt		2.8	10	5.1	2½
9 Rotorua	Taupo 8aH & 8a, & 8b sandy silt, Rotomahana 3, 3a, 3H		2.5	10	7.8	4.5
10 Waimana	Whakatane 51H gravelly loam	.07	1.8	10	4.7	3
11 Hawkes Bay	Gwavas 74, Oharu 79 Ruahine 124 Whangaehu 114 Taihape 140	.03	.5	8	3.4	2:1½:½:2:3
12 Hawkes Bay	Otamauri 11H sandy loam		2	3	4.6	2
13 Dannevirke	Wanstead 25aH		1	10	5.9	3
14 Masterton	Atua 29 & 29H Taihape 114a, Matakona 120, Bluff 113 Kumeroa 29f & FH	.55	1	10	5.9	2:3:1:3:2½
15 Kaikoura	Wad & Medway hill soils	8	1.3	11	2.1	
16 Marlborough	Haldon & Hurunui	.6	1.2	10	2	
17 Waipara	Onepunga & Waikari hillside		.7	9	2.1	
18 Waimate	Hurunui steep land		.7	9	2.5	
19 Southland	Kihiku 60% Kauroira 40%	.2	.5	10	3.2	
20 Wallace	Mangapiri 85%	5.1	1.4	6	6.1	

DISCUSSION

Actual results from improved management have exceeded predictions of potential carrying capacity on all soil types in the group. The quantity of phosphate used on the higher rainfall North Island soil - (2 cwt per acre per year) is double that used on the lower rainfall South Island soils and the response is of a corresponding order.

With one exception very small quantities, or no lime, was used on North Island soils while there was a strong trend to greater use of lime on South Island soils.

Considering the wide range of parent materials from which the various soils are derived and the physical differences between them the performance of the soils in terms of sheep equivalents being carried is remarkably uniform in the North Island.

This tends to emphasise the dominating influence of grazing management factors which are outside the scope of this study.

CONSERVATION RESPONSE OF HILL SOILS

Owing to various combinations of steepness, severity of frost, wind and rain; overgrazing and burning of natural vegetation; and inherent erodibility of parent material hill soils suffer severely from accelerated soil creep, sheet, scree, slip, flow and gully erosion. Because of the response of eroded hill soils to aerial seeding topdressing with phosphate and spelling, regeneration of protective and productive pastures has laid the foundations of a conservation farming system. Aircraft provide an essential practical means of seeding, fertilizing, rabbit poisoning, weed control and delivery of fencing materials on these higher, steeper and inaccessible soils. The results of treating and spelling such eroded hill soils have been most regarding - completely protective cocksfoot, tall oat grass, red clover and white clover pastures have been regenerated that minimise soil erosion and flood-producing run off on some of the hill soils in the South Island. The quantities needed and rates of recovery are directly related to soil types. These results obtained on the Soil Conservation Council's Reserves and on catchment control projects have set examples that farmers are actively following.

MID DOME - SOUTHLAND.

One thousand acres of sheet and scree eroded mountain side (1000' - 4000') slashed with active gullies, and denuded of vegetation was treated and now provides an increasingly protective and productive cover under the light grazing of 500 sheep equivalents (it carried approximately

50 initially).

EARNCLEUGH - ALEXANDRA

Four hundred acres of scab weed and bare, sheet-eroded land was lightly aerially seeded with cocksfoot, white and red clover which reseeded effectively under a spelling and light grazing programme and developed a new productive sward capable of carrying more than one sheep equivalent per acre.

TARA HILLS - WAITAKI - 8,000 ACRES

The almost completely denuded and scab weed infested sunny slopes have been largely revegetated with cocksfoot, white and red clover - achieved by rabbit and fire control, oversowing, topdressing, spelling and moderate grazing to make possible a much more intensive pattern of pastoral use.

2 HIGH COUNTRY RUNS:

The response of South Canterbury high country to aerial topdressing, oversowing, rabbit control, fire control and moderate grazing on two co-operative demonstration farms has resulted in doubling carrying capacity and improving the protective value of pastures.

WITHER HILLS, BLENHEIM

Severely denuded, sheet and gully eroded, low rainfall hill country carrying $\frac{1}{2}$ a sheep per acre has been restored to 2 sheep per acre capacity with a combination of fire control, spelling, cattle grazing, oversowing, topdressing, water supply, and contouring of the lower slopes to bring run-off and soil erosion under control.

TANGOIO - HAWKES BAY

Severely slip and sheet eroded, deteriorated, manuka-infested danthonia hill country carrying one sheep per acre has been restored to three sheep (+ cattle) per acre by aerial topdressing, over-sowing, fencing, cattle grazing, spelling and tree planting for stability.

WAERENGA-O-KURI - GISBORNE

Severely gullied, slip and earthflow eroded, shattered, mudstone hill country has been progressively stabilized by spelling, gully planting, cattle grazing, oversowing, topdressing and moderate grazing to treble its carrying capacity and reduce run-off and soil loss.

The measurable harvest of increased productivity is probably surpassed in material value by the indirect "uncashed" harvest of soil protection and increasing control of sheet, scree, gully, slip, earthflow and river erosion coupled with increasing control of run-off water which aggravates these and causes flooding.

PERFORMANCE OF THE AVIATION INDUSTRY

In over twelve million topdressing, weed spraying, seed-ing, rabbit poisoning, insect killing and fencing and supply dropping flights to date, this new agricultural task force is healing the scars of erosion, minimising the rate of run-off and reducing flooding, as well as enhancing production.

Distributing $4\frac{1}{2}$ million tons of phosphate to date, on 45 million acres of unploughable hill country is indeed a herculean task, making aircraft the principal agricultural implement. The 650,000 tons distributed over a recent 12 month period is equivalent to a half ton plane load of super distributed every 6 seconds of each minute, of each working hour (8) of each working day in the year (260 days). More phosphate is distributed by aircraft per year than was manufactured when the Aviation Industry started in 1959. During the 12 million flights made on deteriorated hill country the Industry has done the equivalent of 10 million man days of work towards its improvement (95% of this work being aerial topdressing).

Over 250,000 tons of lime have been spread to correct lime deficiency in the more deficient regions.

Nearly 6,000 tons of clover and grass seed have been spread in seeding and topdressing sorties to utilize phosphate and lime efficiently in building up fertility.

Probably the most spectacular and previously insurmountable task achieved, has been the literal bombing of rabbits into oblivion with 40,000 tons of rabbit baits under the Rabbit Destruction programmes of Rabbit Boards.

Gone is that familiar bare, hungry, "rabbity" appearance of millions of acres of hill country landscape - tomorrow opossums, deer, goats, thar and chamois, may have a similar fate as trials by Forest Service are most promising.

Wallabies were wiped out by aerial poisoning recently in the Hunter Hills.

34,000 tons of chemicals that make weed and insect control so effective have been given a new order of efficiency by aircraft as they can be applied to thistles, ragwort, gorse

and other weeds in inaccessible hill country while grass grub, army work and even cattle ticks are being controlled, for the first time in the history of hill country farming.

Upwards of 5,000 tons of fencing and other supplies have been dropped on high, steep and remote hill country to complete this mechanisation of hill country farming. By using modern light-weight galvanised steel posts and battens new and permanent, acceptable standards of fencing are available on hill country that are adequately robust in contrast to electric fencing. The weight of these all-steel fences (5 tons per mile of standard fence) contrasts strongly with the weight of wooden post fencing (18 tons per mile).

The outcome of the exploratory aerial fire fighting trials is that the Aviation Industry has indicated its willingness to make its aircraft available on a search and rescue basis, as it considers forest fires a national disaster. Simple plastic linings have been developed that can be fitted to adapt fertilizer hoppers for dropping water on fires.

Perspective is given to the magnitude of the contribution being made by this Industry in building the soil fertility resources of the country when it is realised that the cost of materials dropped to date is well over £80 million. The earnings of the Operators has grown to approximately £3 million annually.

DIRECT HARVEST OF INCREASED PRODUCTION

Mixed grass and clover pastures are replacing danthonia and brown top, on deteriorated scrub and slip-infested North Island hill country pastures, and revegetating the depleted tussock country of the South Island.

As most of the super is spread on hill country the Industry has played a big part in increasing the cattle and sheep populations by 50% in the past 12 years - (it took 48 years to give the previous 50% increase).

If half the extra 1 million cattle and 16 million sheep increase is attributable to aerial farming the increased annual returns are worth £16 to £20 million while the increased value of the land is of the order of £150 million (based on the value of enough land to carry a sheep being worth £15).

SUMMARY

The acuteness of the inter-related problems

in depleting the fertility of the cinderella, hill soils reached its climax during the war. These problems are being solved by a combination of investigation, (soil survey, conservation, rabbit destruction, Noxious Animal Control and Marginal Lands Acts), farmer enterprise, buoyant prices, response to phosphatic topdressing and seeding and mechanisation of hill country farming by aircraft, (8)

As forecast in soil surveys the capacity of hill country soils to respond to management varies, and the potentials of these soils have been exceeded in all cases with conservation farming methods to recoup a double reward - control of soil erosion and run off and greatly enhanced production. The New Zealand average increase of 50% in cattle and sheep over the previous 12 years has been more than doubled in 9 years on the 20 farms investigated, indicating the tremendous boost that aerial farming has given to hill country production,

It has made possible a momentous transition from the soil exhausting phase of the first century of farming to a soil conserving and fertility building phase in the second century of land use. By making conservation work practical on eroded hill and mountain lands, it becomes New Zealand's Conservation Air Arm.

POTENTIALITIES OF THIS FERTILITY MAKING BUSINESS

It is just as difficult to estimate the levels to which fertility can be built in future as it has been in the past. Based on the small sample of farms used, which represent approximately 1/500 of the area of similar land, in New Zealand, indications are that the hill country is capable of carrying more sheep than the total carried in the country today (50 million) and well it may have to, if the present rate of sheep population growth is maintained (a 50% increase in the past 12 years). At this rate New Zealand would have to cater for a total sheep population of 100 million in the 1980's.

This challenging situation, however, is matched by the new tempo of growth given to fertility building by aircraft. Over a period of 13 years, the average annual increase of phosphate distributed has been 50,000 tons and over recent years approximately 10% per year. If present trends continue, over 1.2 million tons per year will be distributed by 1970 (in fact this is the approximately capacity of the present fleet of aircraft) and 2 million tons by 1978-80.

Now that aircraft have broken the slope barrier and become conventional farm implements the extent of their

service to agriculture is limited by man's ingenuity to develop new uses for them rather than by their limitations. Aircraft can provide an extended range of services such as fire fighting, killing noxious animals, cultivation and seed injection into the soil for regrassing and afforestation of steep lands. Thus man's ingenuity limits the extent to which soil fertility can be built on hill country with Aircraft.

REFERENCES

1. 1954 Taylor N.H. "Soils of North Island of New Zealand" - D.S.I.R. Bulletin 5 - Govt. Printer.
2. 1945 "Maintenance of Vegetative Cover" on N.Z. Report of Committee of Inquiry - Govt. Printer.
3. 1947 Campbell D.A. "Types of Soil Erosion in New Zealand" - Paper Royal Soc. of N.Z. - 6th Sc. Congress.
4. 1946 ————— "Down to Sea in Slips" - Soil Conservation & Rivers Control Council Bulletin 5.
5. 1948 ————— "Preliminary Aerial Topdressing Trials" - N.Z. Jou. Sc. & Technology
6. 1949 ————— "Aerial Topdressing in New Zealand" N.Z. Sc. Review 7 p.p. 156 - 60
7. 1961 ————— "The Sky's The Limit" - Address to Annual Meeting Aviation Industry Assn. Annual Report 1962.
8. 1950 ————— "Development of Aerial Topdressing of Grasslands as a Conservation Tool to minimise run off" Trans. Int. Cong. Soil Sc. Amsterdam Vol. 1.

Some Statistics

		Principal Aircraft used	
		1957	1962
No. of Topdressing Aircraft	247		
" " Operations	59	Tiger Moth	102
Trained Staff	740	Fletcher	17
Flights p.a.	1,100,000	Piper	42
Hours flown	95,000	Cessna	38
Phosphate spread p.a.	650,000 (tons)	Auster	34
Area Topdressed	5,600,000 (acs)	Beaver	35
Topdressing is 95% of Agr. Aviation		Lodestar	5
Operators gross earnings £3 million (approx)		Dakota	1
			3
			1

Number of Airstrips over 12000

Cost of Airstrips £250 - £500 (most common) paddocks also
used

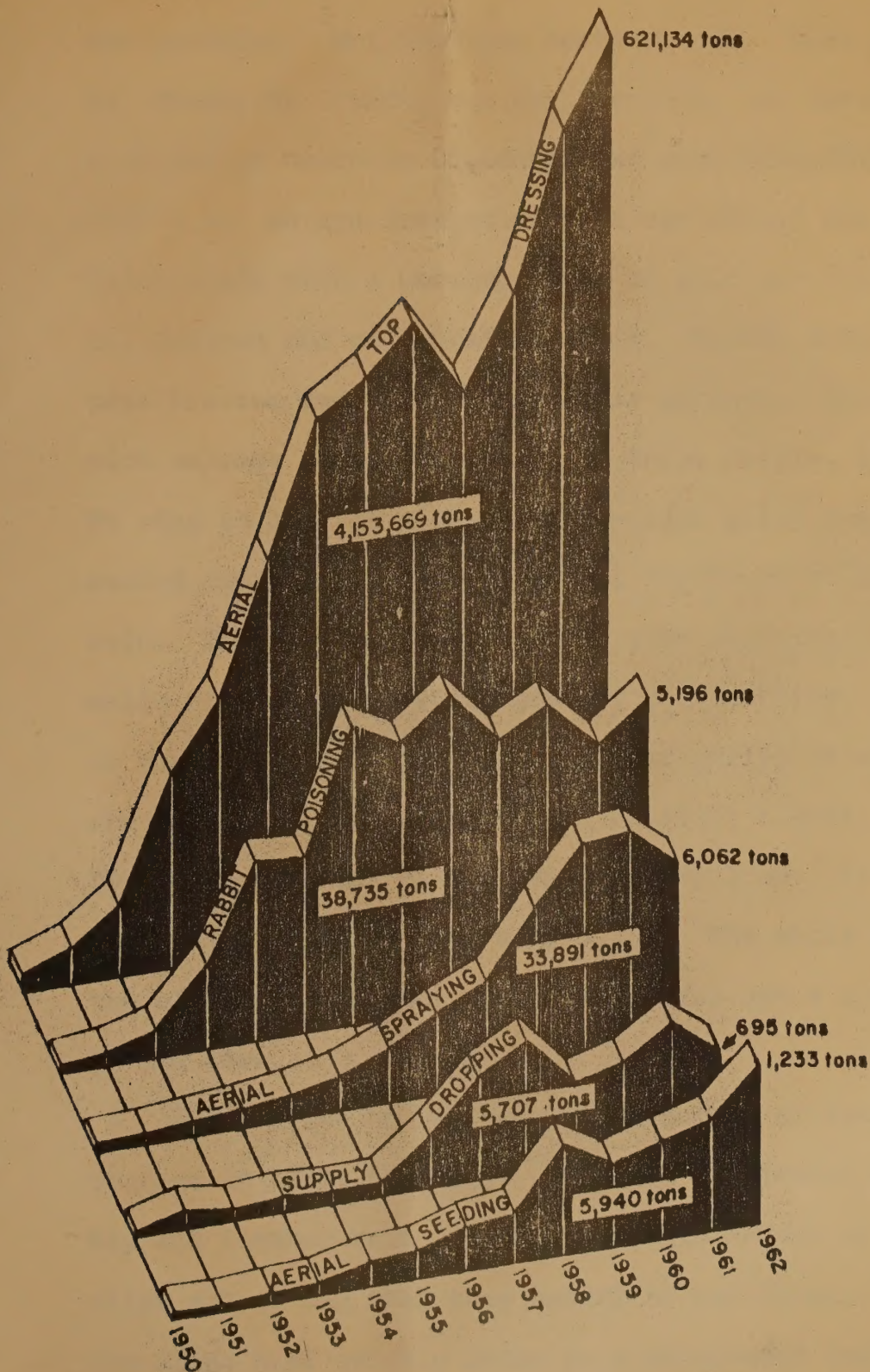
Rate of Application of Phosphate - 2 cwt per. ac. (most common)

Cost of spreading by Aircraft £3.15 per ton (most common)

Total component costs per acre per ton

Fertilizer	£10		
Railage from			
Works	1	7	6
Cartage to Air-			
strip	1	.	.
Aerial spreading	3	15	.
Interest on Air-			
strip	.	5	.
Other		8	4
	£16	15	10

STATISTICS OF AERIAL FARMING IN NEW ZEALAND



After lunch I go in a car north of Palmerston North into the so-called Te-Awa-Pohangin District to look at the pastures. Mr. Suckling takes us out. Also along are Dr. Stone, Dr. Finck, and Mr. Vucetich. We leave about 1:40 and go north to Fielding. We pass Bunnythorpe about 2:00 p.m. We are driving over an old cobbly and gravelly flood plain with a varying cover of silt and with both ill-drained and well-drained soils. Beyond Fielding we pass Kiwitea and turn onto a lower terrace. Here are nice cabbage trees, lupines, and Angus cattle. (K-3092). We stop to look at a deep, steep-sided gully that was washed out along a road in only a few hours of heavy rain. This is now stabilized by tree plantings near the walls of the gully, which prevent undercutting. We drive on north and see a few more very bad gullys in soft silt- and mudstone (Papa formation). (K-3093; K-3094; K-3095). The soils here are called Raumai sandy loam. All of these kind of soils have many slips. The whole surface of the slopes consists of stabilized slips and a sprinkling of new ones.

As we drive on we see quite a number of fresh slips started in 1961. (K-3096). They had 8.8 inches of rain in May and further rain in June and July. A few of these slips are so big that they amount to mud flows. Usually the slips heal quickly under good management including



K-3092 November 17, 1962. New Zealand. Near
Kiwitea. Cabbage tree in pasture.

III
5

K-3092 November 17, 1962. New Zealand. West
Kiwitea. Cabbage tree in pasture.



K-3093 November 17, 1962. New Zealand.
North of Kiwitea. Accelerated
erosion near lower end of gully
on Raumai sandy loam over silt-
and mudstones.

K-3093 November 17, 1962. New Zealand.
North of Kaitake. Accelerated
erosion near lower end of gully
on Rammed sandy loam over silt-
and mudstones.

up
2
X

1962



K-3094 November 17, 1962. New Zealand. North of Kiwitea. Accelerated erosion near upper end of gully on Raumai sandy loam over silt and mudstones.



K-3095 November 17, 1962. New Zealand. North of Kiwitea. Accelerated erosion near upper end of gully on Raumai sandy loam over silt-and mudstones.

IX/1

XII/7

November 17, 1982. New Zealand. North
of Kaitake. Accelerated erosion near
upper end of gully on Raurimu sandy loam
over silt and mudstones.

K-3094

November 17, 1982. New Zealand. North
of Kaitake. Accelerated erosion near
upper end of gully on Raurimu sandy loam
over silt and mudstones.

K-3095



K-3096 November 17, 1962. New Zealand. North of Kiwitea. Slip erosion from the winter of 1961 (8.8 inches of rain in May, June and July were also wet.) Soils from soft silt- and mudstones.



K-3097 November 17, 1962. New Zealand. North of Kiwitea. (Near grassland station). Recent mud flow (1961) on improved pasture.

X-3088

November 17, 1962. New Zealand. North of
Kiwitea. Slip erosion from the winter of
1961 (8.8 inches of rain in May, June and
July were also wet.) Soils from sandstone
and mudstones.

X-3087

November 17, 1962. New Zealand. North of
Kiwitea. (Near grassland station). Recent
mud flow (1961) on improved pasture.

aerial fertilizing and oversowing but last summer was too dry for them to be covered with grass.

We stop at a small experimental station on very hilly soil that has been well fertilized. (K-3097; K-3098). Here there is experimental grazing of sheep at several stocking rates. Most sheep growers carry $1\frac{1}{2}$ ewes per acre. Here some of the paddocks go up to 7 ewes per acre with little or no effect on the slips. Grass roots simply do not hold them anyway. If anything, the combination of phosphate, good seeding, and intensive grazing that keeps down the coarse growth does better to avoid slips than light grazing. (K-3099; K-3100).

We then go on back to Massey College on the high terrace. Most of the land is in sheep pasture. Unhappily our guide is exclusively specialized in grassland experimental work and has little interest in soils and soil erosion.

At 5:30 we are back, I have a cup of tea and then dinner. I read awhile and go to bed at 9:00.

November 18: After breakfast I rearrange my papers, read over my lecture and do a bit of writing. I spend most of my time in chit chat with the others. I have afternoon tea chez Dr. and Mrs. H. Jacks.

After dinner the girls help me build a fire in the common room. We read and talk a bit.

Then to bed at 10:00.

g5a



17 Nov. 1962

Experimental Layout



K-3098 November 17, 1962. New Zealand. North of Kiwitea (Near grassland station). A closer view of recent mud flow (1961) on improved pasture.



K-3099 November 17, 1962. New Zealand. North of Kiwitea (Near grassland station). A view of slips in pasture.

XIII

K-3098 November 17, 1962. New Zealand. North of
Kiwitua (near grassland station). A closer
view of recent mud flow (1961) on improved
pasture.

K-3099 November 17, 1962. New Zealand. North of
Kiwitua (near grassland station). A view of
slips in pasture.



K-3100 November 17, 1962. New Zealand. North of
Kiwitea (Near grassland station). Pasture
with old slip scars.

LXIX

K-3100 November 17, 1962. New Zealand. North of
Kiwitea (Near grassland station). Pasture
with old slip scars.

November 19: For some reason I slept badly, perhaps because of a nap yesterday. Today is cloudy, rainy, and windy. I have tea again with Norman.

At breakfast it is announced that the demonstration of aerial topdressing must be canceled because of the bad weather. Instead a film is shown.

It is remarkable what has been done in the last 12 years with aerial farming:

1. Top dressing, including the application of phosphates, lime, sulphur, etc. Now in New Zealand one-half ton of fertilizer is spread by a plane every six seconds of the working days they can fly.
2. Seeding of clover and grass seed.
3. Spreading of poisoned carrots for rabbits and deer.
4. The accurate placement of fence posts and wire in areas that can't be reached with vehicles.
5. The distribution of chemicals, both herbicides and pesticides.

Sometimes I think my New Zealand friends are a bit naïve in recommending their system to other areas. It works here so well because of the generally high and dependable rainfall, the moderate temperatures, and the general responsiveness of the soils. In most other places the clover-ryegrass mixtures would go out from cold, heat, or drought.

After lunch we have the session on tropical soils (C12). This isn't especially good. The point is made that

phosphorous is essential if good fallow plants establish themselves at the end of the crop cycle.

In Dr. Sherman's discussion of liming the Latosols he neglects the very important time factor and we have a good discussion of this afterwards.

Then tea and the brief afternoon session, C13. I am a bit disappointed in Dr. H. N. Mukerjee's paper on soils of the paddy fields. It is quite unclear.

The paper by I. Kanno on a new classification system of rice soils in Japan is well worth study.

After the sessions we go to dinner and then down to the opera house in the city where I give my public address on Man and the Soil: The Challenge of the Future. Since I had this title about three days before leaving the United States I simply reworked the talk I gave at Ithaca last August on the world food problem and added some local applications.

The speech seems to go quite well. There is a long question period and afterward my colleagues are very generous.

Although late back to the College I am not yet sleepy. I sit up too late for chit chat with Taylor, Tavernier, and Marechal.

Notes Used
Nov. 19, 1962

Man and the Soil: The Challenge of the Future

Charles E. Kellogg

Improvements in soil use during the past 25 years, shown in fields and in agricultural efficiency, have been phenomenal. We can say without fear of contradiction that this is one of the greatest scientific success stories of human history. And the rate of improvement is still accelerating. Similar advances are being made in forestry and other uses of our soils. And really we have only begun to put soil science to work.

But the story is quite different in many of the newly developing countries where populations are increasing nearly as fast as the food supply.

The phenomenal improvements in food production have come from a long background of research and experience, mainly on the soils of the temperate regions. Commonly we think of them as "ordinary" soils and look on the tropical soils as "peculiar." Of course, neither group is peculiar, but they are basically different in properties, in behaviour, and in the combinations of practices required to develop good arable soils from them. The agriculture of the temperate regions developed to a fairly high state before there was much industry. In fact, the capital for starting industry came largely out of agriculture. And industry, in turn, helped to improve agriculture still further.

Our greatest technical advance in the agriculture of the advanced countries since 1935 has been the application of the principle of interactions. I mean by this the use of a set of practices adapted to the local kind of soil such that each practice helps the others to

be effective. And the general lack of application of this principle is the greatest single handicap to advancement in the newly developing countries.

A quick examination of the important food-deficient countries in the world shows that their problems differ importantly from the ones that we commonly work with in temperate regions. We have learned something about tropical soils during the past 30 years and more especially since World War II. But the gaps in our knowledge are enormous. Millions of cultivators are now using soils that have never been studied in any way by soil scientists. No one knows where they fit into any system of classification detailed enough for management suggestions. Nor is the social environment in many of these countries similar to that of the advanced countries. The challenge to soil scientists is simply enormous. Although I recognize the importance of many other phases of agriculture, I am willing to assert that unless the soil scientists get at their jobs, and do them well, not much improvement can be expected. We must know what combinations of practices are adapted to each kind of soil.

I do not mean by this that we accept the soils as they are now. Not by any means. When I look at a soil anywhere in the world, I think very little about what we can do with it as it is. The question is: How will it respond to sets of management practices, including all our modern machines and chemicals for changing it, and if we use the improved kinds and varieties of crops with the genetic potential to respond to combinations of practices for high fertility, proper amounts of water, and pest control?

Actually the world has abundant soil resources for a greatly increased food supply if they could be reasonably well used. Even if

food were abundant the world around, we could not be sure of peace. Men fight about other things too. But without adequate food we can be certain of no-peace.

Over a decade ago we made estimates of world food potentials, assuming levels of management comparable to those of the moderately advanced countries. The potential increase in harvest from soils already in use, coupled with that from an estimated 1.3 billion acres not then in use but suitable for crops, was ample to meet the estimated food needs of the world for a long time in the future. If these estimates had been made under the assumption that all farmers could operate at the level of efficiency of those in Holland, for example, the figures would have been much higher. Even estimates under the more moderate assumptions that we used in 1950 would be higher if made today. The influence of modern soil science is not only to increase yields from arable acres in use but also to increase the number of acres that can be used for food crops. Although the total land area of the world is relatively fixed, the percentage that can be made into arable soil is highly flexible, depending upon the state of the agricultural arts, country by country.

General estimates on a world basis can be misleading. The opportunities are distributed unevenly in the world. Ironically, but fortunately, a high proportion of the underdeveloped countries have large areas of potentially good cropland not being used. China does not, and perhaps a few small countries of semiarid regions are limited. Certainly there are great areas of potentially good arable soil awaiting development in Africa and especially in South America. But facilities for soil use and development are unevenly distributed

among countries and regions.

We must continually recall that the people of the world do not get their food from a common storehouse. Most countries produce their own food themselves or within their customs union. Actually, only a small percentage of the food of the world gets into world trade. Thus when we speak of improving the world food situation we are talking about a problem that is highly variable from place to place and that must be dealt with mainly country by country. Now I do not want to say that world trade is unimportant. Not at all. Such trade is highly important, not only in food but especially in the means of food production.

Countries like New Zealand must trade, and not just with Europe and the Commonwealth countries. All the advanced countries will tend to have agricultural "surpluses" for some time. New Zealand will need to re-examine her own agriculture. Possibly it will be easier to sell high-quality beef in Japan than high-quality butter in Europe.

We cannot lay out the world food problem in terms of soil science alone. Rather I should like to indicate some of the broad problems that must be overcome before we can expect efficient soil use and management as we understand it. Although some of these are not strictly soil problems everyone must recognize them and work on them if we are to be reasonably successful. By being successful I mean turning the revolution of the underdeveloped countries along constructive lines instead of waiting for some destructive holocaust.

I would emphasize the problem of the low social status of the cultivators as the greatest handicap to soil use in the newly developing countries. Somehow that status must be lifted and I hope

by peaceful means. Once a revolution gets started, it is hard either to control or to predict.

Few of the cultivators have an opportunity for an education. Perhaps if they had access to facilities to learn to read, say as well as our fourth graders, the effects would be great. Now few of them have this opportunity. This means that few village boys and girls get into places of influence. Especially meager are the opportunities for women in many countries. And we cannot expect ignorant women to get their children started well.

Most of the government leaders are from towns and know little about agriculture. They simply take it for granted that agriculture is a simple enterprise. We know that nothing could be further from the truth. Even a high proportion of the agricultural advisers and research staffs come from towns. They find it extraordinarily difficult to work with the cultivators as fellow citizens. Many of these advisers are sincere and are willing to do things to the cultivators and for them; yet they are unable to work with them.

As another corollary to their low social status, cultivators generally lack the ordinary social services. Probably around 100 to 200 million people in these areas live under some system of shifting cultivation. A large part of them have no roads to their villages. Besides lacking schools, cultivators lack medical services. And they also lack an effective voice in the national government - in politics - which is sometimes called the science of who gets what.

Again and again we hear that the country people in the under-developed countries lack initiative or incentive - they are lazy. Think of most of us at this moment: If we were unable to read, were

under-nourished, had malaria and perhaps other chronic diseases, and had only part-time employment, might we not give a similar impression?

Modern world history tells me that these cultivators have realized their educational handicap for a long time. Actually they are no worse off now than they ever were. In fact, most of them are probably somewhat better off. But people of the United States, Western Europe and other advanced countries get around a lot. They have seen us. They have heard about our living standards. They have heard about our political systems. They have seen or at least heard about our surpluses. And especially have they heard that we have schools for everyone. Now they realize that the social conditions under which they live are no longer necessary. They are ready for new outlooks and new learning.

Perhaps if each of us were to go from Casablanca across North Africa, and through Southern Asia to Hong Kong, and could get out in the country, we might say that these people need more food, better houses, better roads, and so on. But we would be thinking of what we would want if we were living there. The cultivator has, I believe, a different point of view. I believe he wants two main things, especially for his children: For them to stay well and live, and for them to be able to read. These he would put ahead of driving the rats out of the walls and the cobras from the thatched roofs and many of our other "necessities." He knows that most people unable to read stand apart from the main events that count.

The second greatest handicap of effective soil use in the newly developing countries, in my experience, is the general lack of appreciation of the principle of interactions - that on any one acre many practices must be uniquely combined to fit the local kind of soil.

In this area soil scientists have already made a great contribution, certainly one of their most important during the last 25 years.

A third great handicap to soil use is the difficulty of providing for the transfers of knowledge and skill from advanced countries to the newly developing countries, which means mainly from temperate areas to tropical and subtropical ones. Few actual soil management practices can be transferred. On the scientific side this is because of the great differences in soils and other growing conditions. On the social side, it is because of the great differences in facilities for agricultural development. In countries like New Zealand and the United States we almost take for granted our educational system, our banking and credit institutions, and the services for chemicals, machines, and the like provided out of the private sector. Farmers in my country have increased their annual investments in fertilizers something over 5-fold since 1935. I am sure that the chemists and sales force of our competitive fertilizer industry had much to do with this.

What can be transferred from temperate regions to the tropics and subtropics are basic principles and the skills for learning - the skills for problem diagnosis, research, and testing. This means great emphasis on the basic training of key individuals, both in the advanced countries that are helping and in the receiving countries. Where the social systems are alike and the soils are similar an experienced advisory agent without basic training can be expected to do well; but we should not expect him to do so where either are greatly different.

Great need exists for more emphasis on two scientific activities in the newly developing countries: general research stations and field

and facilities. We have already in the tropics a fair number of commodity experimental stations. A few of these are quite good, but are poorly financed and poorly staffed. What we need are research stations with adequate facilities and staffs in the fields of agriculture. Such a staff can receive and use basic principles and can develop combined practical and theoretical many interactions. The basic functional sciences like soil science, entomology, genetics, plant pathology, and economics and as well as agronomy, horticulture, and forestry. What I am referring to is a few more general research institutions like the ICRAC in Congo. It is a current tragedy for tropical agriculture through the world that this great institute is in critical jeopardy. Accordingly, we need soil surveys and other field research and field stations of the low social prestige of agriculture it is difficult to find local staff for scientific work and of course attracted to work in laboratories. I realize that it takes time to build good general research institutions, but soil surveys, other field studies, and field testing can be undertaken quickly and that the extremely difficult problems of recruitment and training and solved. Therefore I emphasize the importance of country planning in these developing countries. I should like to say a word about the action of capital for both agricultural and industrial development. The general principles of Keynesian economics have been popularized during the past 25 years so that most people are not economic growth requires the continual saving and reinvestment of the production in order to expand and improve the

whole productive apparatus. In most of his writing, Professor Keynes was dealing with the current economic problems of the advanced countries where agriculture was already well advanced. Thus distinctions between investments in agriculture and in unrelated industries became blurred.

Actually, the original accumulation of capital for industries in the advanced countries came out of agriculture. So far as I know, every country that has developed industrially had first an agriculture producing a surplus, either within the country or within its customs union. Although we should not expect the newly developing countries to proceed in exactly the same way, it seems evident that economic growth must begin with agricultural development. Agriculture must begin to produce a surplus over the minimum food needs of the population. The first industrial development should favor those industries such as chemicals, transport, marketing, and the like that help agriculture, along with those for some "incentive goods" based on local materials. (And this applies also to fisheries, forestry, and mining.) Then with these industries going well capital can be accumulated for the industries basic to the service industries. Here I'm speaking not simply of nations but of customs unions. As it has turned out I think it is a bit unfortunate that New Zealand has not put somewhat more of the savings from its agriculture into New Zealand industries.

If large industries not directly related to agriculture are started first, serious inflation is highly probable. Wages are paid out and more demand for food is created without an increase in its supply. Then as prices for food go up, cultivators tend to sell less to get their usual money income and to use more food themselves. Thus

unless mining or some other activity earns substantial foreign exchange for food imports, agriculture must improve to be ahead of both population increases and per capita increases in market demands.

I am persuaded that this is an extremely important principle and that we must work hard to get people to understand it. The matter is difficult for several reasons: (1) Agricultural statistics are poor in the underdeveloped countries and hence changes in investment in agriculture are hard to calculate. It is easier to see and evaluate hydroelectric dams, steel mills, and large factories. (2) A high proportion of the people in government, and their economic advisers have not made this important distinction, partly because of the low social status of agriculture and partly because they have taken their ideas from the current, empirical economic situations in the advanced countries, which fail to recognize the special economic priorities at the early stages of economic growth. (3) Some have been unduly influenced by the example of the Soviet Union which did put great emphasis on basic industries as contrasted to agriculture with results that appear to be unsatisfactory to the present leadership of that country.

At present it seems to many of us that relatively too little emphasis is being given through the various technical assistance programs to the agricultural sector and its closely related industries. As a matter of fact in many of these countries, from some outside sources, one can find nearly every kind of improvement going on. A case can be made for most of these, all the way from chamber music to nuclear reactors; yet the result is that the small core of educated and skilled people and the scarce foreign exchange are dispersed among

any activities some of which do not help the economy.

Now this leads me to country planning, to which soil scientists can and should make great contributions. First of all, we need good appraisals of the existing resources of soil, water, forests, grazing lands, and minerals under alternative assumptions of management. These appraisals should also take map form. We know how to make schematic and exploratory soil maps at scale of 2 to 4 miles to the inch in order to determine where the best potentialities are. Building on geological and vegetation maps, air photos, climatic data, and the soil explorations that have been made, these maps can be done quickly. But only by very competently trained people. Once the promising areas are located, samples of them should be surveyed in the detail required for operational planning. Along similar lines, appraisals can be made of water resources, forestry, and minerals.

We also need an appraisal of the human resources, especially by skills. In most of these newly developing countries we find the greatest skills in agriculture and probably next in forestry and fishing.

With these backgrounds it is possible to set up a broad plan for the country in order to concentrate on those areas where the economic outlook is best considering the resources and the population. Certainly, education and medical services would be high on a priority list. Modern agriculture requires people in good health with education. Especially favorable sites for hydroelectric dams that would help to develop mineral resources, to furnish power for fertilizer plants, and to furnish irrigation water, should get high priority. In my view some of the many other amenities should be postponed until the economy gets well under way.

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No country will or can follow an idealized procedure. In democratic countries the leaders must be elected and they want to get re-elected. So they will need to use some foreign exchange for movies, lipstick, and the like, whether they want to or not. This is not always bad if they know what they are doing and hold reasonably well to the top priority items. Then too, we are all inclined to say to people in the newly developing countries: It took us in the West some 200 or 300 years to industrialize and to reach our present economic status, so you have got to go slowly. Although sound advice perhaps, they will not go slowly. In my view, the next 5 years, at the most 10, will be the critical ones. Time is short.

Most of these countries have recently acquired their freedom and a new nationalism. The people expect great progress. They are not always patient. So compromises will need to be made with ideal schemes. But if agricultural production were speeded up enough, as it easily could be from a scientific point of view, production could increase faster than population. Then with reasonable savings for reinvestment in agriculture, in service industries, and ultimately in basic industry, the problems could be met.

Soil scientists cannot do it alone. Nor can it be done without us. If the reasons why we should work at it are not clear now, I urge with all emphasis the rereading of world history since 1900, especially the history of revolutions.

-----oOo-----

"N.Z. should have put more into industry"

"The original accumulation of capital for industries in the advanced countries came out of agriculture, and as far as I know every country that has developed industrially had first an agricultural surplus."

This was stated by Dr C. E. Kellogg, head of the United States Soil Survey, when addressing an audience of soil delegates and the public in the Palmerston North Opera House on Monday.

This was the second public lecture to be held during the current international soil conference, and Dr Kellogg's subject was: "Man and the soil: The challenge of the future."

He said: "Although we should not expect the newly developing countries to proceed in exactly the same way, it seems evident that economic growth must begin with agricultural development. Agriculture must begin to produce a surplus over the minimum food needs of the population."

"The first industrial development should favour those industries, such as chemicals, transport, marketing, and the like that help agriculture, along with those for some "incentive goods" based on local materials."

"Then with these industries going well capital can be accumulated for the industries basic to the service industries."

Dr Kellogg said: "Here I'm speaking not simply of nations but of customs unions. As it has turned out I think it is a bit unfortunate that New Zealand has not put somewhat more of the savings from its agriculture into New Zealand industries."

"If large industries not directly related to agriculture are started first, serious inflation is highly probable. Wages are paid out and more demand for food is created without an increase in its supply."

SELL LESS

"Then as prices for food go up, farmers tend to sell less to get their usual money income and to use more food themselves. This unless mining or some other activity earns substantial foreign exchange for food imports, agriculture must improve to be ahead of

both population increases and per capita increases in market demands.

"I am persuaded that this is an extremely important principle and that we must work hard to get people to understand it," said Dr Kellogg.

The matter is difficult for several reasons:

- Agricultural statistics are poor in the underdeveloped countries and hence changes in investment in agriculture are hard to calculate. It is easier to see and evaluate hydro-electric dams, steel mills, and large factories.

- A high proportion of the people in government, and their economic advisers, have not made this important distinction, partly because of the low social status of agriculture and partly because they have taken their ideas from the current, empirical economic situations in the advanced countries, which fail to recognise the special economic priorities, at the early stages of economic growth.

- Some have been unduly influenced by the example of the Soviet Union which did put great emphasis on basic industries as contrasted to agriculture with results that appear to be unsatisfactory to the present leadership of that country, Dr Kellogg said.

"At present it seems to many of us that relatively too little emphasis is being given through the various technical assistance programmes to the agricultural sector and its closely related industries."

As a matter of fact in many of these countries, from some outside sources, one can find nearly every kind of improvement going on.

"A case can be made for most of these, all the way from chamber music to nuclear reactors; yet the result is that the small core of educated and skilled people and the scarce foreign exchange are dispersed among many activities, some of which do not help the economy."

THE NEW DAILY COURIER AND JOURNAL
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FINALLY
THIS WEEK

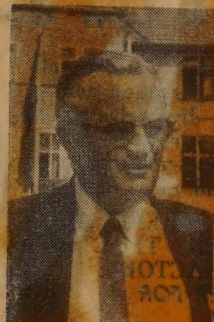
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"Young Farmer", February 1963.

Wellington, New Zealand.

Head of U.S. Soil Survey Commends Science Education for Girls

FURTHER education for young people and encouragement especially to girls to continue their studies in mathematics and science were advanced by Dr C. E. Kellogg, Head of the United States Soil Survey and a leading overseas participant in the International Soil Conference at Massey College in November, as an important means to attainment of full use of the world's soil resources.



Dr Kellogg

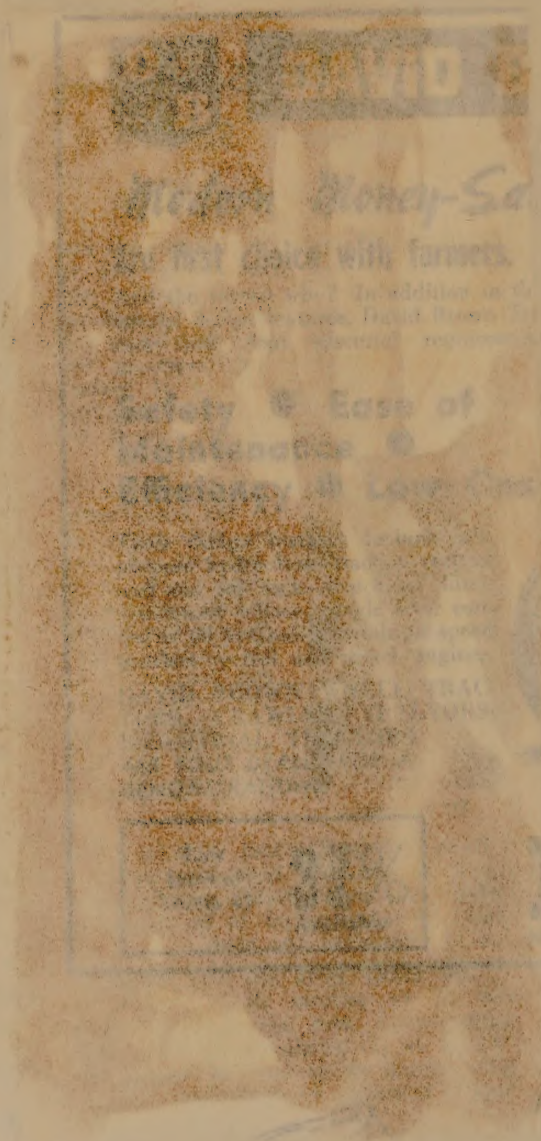
IN his paper to the conference, in discussion at the end of sessions, and in a public address in Palmerston North, Dr Kellogg referred frequently to the great handicap that lack of education was to progress in the newly developing countries.

Even in New Zealand, with its intelligent people and high standards of culture, too many young people, especially girls, appeared to be dropping out of education too soon.

"Too many girls are told they are not fit to pursue their studies in mathematics and science," he said. "There is no evidence to show that girls cannot do as well as boys in the higher branches of education."

"Young Farmer", February 1953.

Wellington, New Zealand.



November 20: Tea with Taylor again, breakfast, and to the sessions (C19 and 14).

E. G. Williams has a good paper but most of the discussion does not thrill me, partly perhaps because I didn't get enough sleep.

After the session we all go for a slowly arranged official photo of the Conference. We have a late lunch. I pose for more photos, and then we go back to the sessions (C15 and 16).

The paper by H. S. Gibbs on steep soils is quite good. He lays down three simple rules: (1) To keep the rates of erosion from exceeding the rates of soil formation; (2) with proper topdressing etc., to have a vigorous vegetation to cycle the nutrients; and (3) a slow enough erosion so that soil structure can form.

Yet with stream undercutting, slips and mud flows are bound to appear under grass, only trees can hold them. Strangely Gibbs doesn't mention this and I chide him a bit. I have a kodachrome taken in the hills near Christchurch that I often use as an example of the planting of trees on the critical slopes and "noses" to maintain good pasture without serious undercutting and slips. This I took in 1949 and I'm wondering if I should use it anymore. I wouldn't want to if it were atypical of New Zealand. He said I might continue to use it!



Conference at Massey College, November 20, 1962

During the tea intermission I have another long interview with the editor of the Journal of New Zealand Agriculture.

Then we go back to the second afternoon session (Cl6). Professor Walker of Lincoln College gives a booming emotional plea for clover as the only reasonable source of nitrogen. His talk might be all right for an extension meeting but it's a bit out of place here.

After dinner some of us go down in the evening to a nice hotel in the city and have a special party for Norman Taylor. The hotel manager furnishes the food and drinks because he knows what Norman has meant to the economy of New Zealand. Mr. Smith of Auckland really spearheaded this and gets contributions from all of us for a nice silver platter and pitcher, suitably engraved. This is for a kind of retirement recognition. I fear I flub-dub a bit. I was to make the pretty speech, which I do; but then I call on one or two others, and everybody makes a pretty speech. I think that Norman is really touched by all of this. Mr. Smith says that Norman is a humble and simple man. When we get back to the college I tell Norman that he has certainly fooled some people: I will grant that he is humble but he is anything but simple. A simple man doesn't get so many people to do just what he wants them to do.

Late to bed again.

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late to bed again.

November 21: I get the airlines to change my ticket again. Then to the sessions (C17).

G. W. Cooke speaks in a very dignified manner about well established concepts and I have little to argue with. In the discussion I do make some remarks about the interpretation of soils according to capability.

Then tea and to the second morning session on soil-forest relations (C18).

Some of this is pretty good but Wilde of Wisconsin makes a characteristically ridiculous speech. I wish that Truog might be here. Wilde says that in 1930 Wisconsin (he didn't say northern Wisconsin) was mostly a land of desolation due to forest cutting and fire. People were without work and many were without food! But reforestation has made a great improvement.

Pierce Ryan says that on soils shallow over horizontal rocks windthrow is important but not on sloping cracked rocks with the same depth of soil.

Two speak of the decline of nitrogen in the soil under old stands of P. radiata in New Zealand.

I say a little bit about what we are trying to do in the United States with soil surveys in forested areas.

In the afternoon I take a few photos. (K-3101). I wrap up some of my conference papers. I take a bath, start my packing, and write home during the lull. I am a bit worried that I have had no letters for more than a week.



K-3101 November 21, 1962. New Zealand.
Massey College. Cabbage tree and
tree ferns in the garden by the
swimming pool.

K-3101 November 21, 1962. New Zealand.
 Massey College. Carboys tree and
 tree ferns in the garden by the
 swimming pool.

NEW ZEALAND SOCIETY
OF
SOIL SCIENCE



RECEPTION

The New Zealand Society of
Soil Science
and
Organisations Associated with
Soil Science in New Zealand

invite

Dr. C. E. Keeloff

to a Reception to be held in the
Exhibition Hall (Wool Room)
Massey College, Palmerston North

on Wednesday, November 21st
at 8.15 p.m.

DRESS: INFORMAL

ASSOCIATED ORGANISATIONS

New Zealand Bankers' Association.
New Zealand Dairy Production and Marketing Board.
New Zealand Farmers Fertilizer Co. Ltd.
New Zealand Wool Board.
Tasman Pulp and Paper Co. Ltd.
Kempthorne Prosser and Co.'s New Zealand Drug Co.
Ltd.
Atlantic Union Oil Co. (New Zealand) Ltd.
Auckland Farmers' Freezing Co. Ltd.
British Phosphate Commissioners.
Canterbury Frozen Meat Co. Ltd.
Crusader Shipping Co. Ltd.
East Coast Farmers' Fertilizer Co. Ltd.
Europa Oil (New Zealand) Ltd.
New Zealand Grain, Seed and Produce Merchants'
Federation.
Potash (New Zealand) Ltd.
Shell Oil New Zealand Ltd.
Union Steam Ship Co. of New Zealand Ltd.
Williams and Kettle Ltd.
Geo. W. Wilton & Co. Ltd.
W. D. & H. O. Wills (New Zealand) Ltd.
New Zealand National Airways Corporation.
Southland Co-operative Phosphate Co. Ltd.
Watson Victor Ltd.
Cadbury Fry Hudson Ltd.
Hawkes Bay Farmers' Meat Co. Ltd.
Sulphur and Chemical Importing Co. Ltd.
Hodder and Tolley Ltd.
Borax Consolidated Ltd.
Levin & Co. Ltd.

After an early dinner we chit chat for awhile and go to a big reception in the Exhibit Hall given by the New Zealand Soil Science Society. We have some pretty speeches that are much too long and then have Mauri dances. During the dance I sit next to Erohina. She tells me that Professor S. N. Ryzov will be the new Director of the Dokuchaev Institute. I don't remember him but she says I met him in the Hungry Steppe in 1958.

While we are speaking Gerasimov keeps interrupting in Russian. Obviously he is asking her what we are talking about. In about 5 or 10 minutes he takes her away.

After the dances there is a great deal of food and drink to be had. I can see this is going to last a long time so about 10:00 I go on to my room. When I get back to the hostel I note that Gerasimov is in his room. He apparently made poor Erohina go to bed and thus avoid more conversation.

November 22: I am up at 6:30 and O'Connor brings me tea. It seems that some of the boys stayed up all night although most went to bed about 3:00 a.m.

After breakfast I do some more packing and mailing.

Then we have a session organized by Dudal on the World Soil Map project of FAO and UNESCO. Dudal gives a strong plea to use base maps at 1:5,000,000 by the Geographical Society of New York. These are made with three slightly overlapping projections that put most of the distortion in ocean areas.

Several speak about progress but Gerosimov lets the cat out of the bag in his speech. He says how important this international effort is and the USSR will have a map for the Eighth Congress as a part of this plan. Then he says that they will also have their own soil map of the World!

From 11:00 to 12:30 I talk with the New Zealand men present who are assigned to conservation work about soil and water conservation, especially farm planning, soil surveys, and the little watershed program.

After lunch I act as chairman for the final session which went well enough except for the eagerness to speak of the gentleman from Wales, who seems to be quite a general expert. We get through the program of Section D. Happily some of the authors aren't present. Then Professor Scheffer, Professor Aubert, and Norman Taylor wind up the Conference with pretty speeches.

Then we go down to the central area and lower the flags that had been placed around the Common.

A few of us from the United States are invited to the home of Mr. Sexton for Thanksgiving dinner. He is a typical Rotarian who had been International President of the Junior Chamber of Commerce (I believe). The walls of his house were literally covered with certificates and other mementos of his journeys. He had been treated so well in the United States on Thanksgiving Day that they wanted to have a Thanksgiving dinner for us. Mrs. Sexton pointed out that she had never cooked one before. It

was very thoughtful of them to invite us.

I get back to the college about 11:00 and find that Norman had left. I had supposed that he would go home tomorrow. I am sorry that I did not stay at the college for the final dinner.

November 23: I am up a bit too early, pack, and make some tea for Tavernier and myself. Breakfast is simple and early because many of the people plan to leave about nine o'clock on the post-Conference tours. I say many goodbyes, chat with people, and take some pictures. (K-3102 - K-3109). The last tour bus leaves about 9:30. Then I get my bags down and wait. About 11:10 I leave on a little bus along with Dudal, Aubert, and Tercinier. We leave Palmerston North for Auckland at 12:07.

Thus I start the long trip home. I wish I were there.

I am down in Auckland at 1:35, take the bus into the city terminal, and go by taxi to the Great Northern Hotel. Here were eight letters from Mommy despite the forwarding address that I had left at the hotel. This is a relief.

It is hot in Auckland so I go to my room and change to summer clothes. Dudal and I have lunch together. I check my ticket. He goes on back to the airport and I walk around a bit. The streets are very crowded on Friday evenings when stores are open, instead of Saturday or Sunday. But I get tired and go to my room for a rest.

I have dinner alone for the first time in a good while.

In recalling the Conference I still can't understand how anyone could be so cold as Dr. Swaby of Australia. He



K-3102 November 23, 1962. New Zealand. Massey College. Dr. K. F. O'Connor in center, far right Grant and Saunder.



K-3103 November 23, 1962. New Zealand. Massey College. Left, Dr. R. B. Miller of New Zealand.

K-3102 November 23, 1982. New Zealand. Massey
College. Dr. K. F. O'Connor in center,
Far right Grant and Saunders.

K-3103 November 23, 1982. New Zealand. Massey
College. Left, Dr. R. B. Milner of
New Zealand.



K-3104 November 23, 1962. New Zealand. Massey College. Just before leaving on tour: l. to r.: Gibbs, Aubert, Tavernier.



K-3105 November 23, 1962. New Zealand. Massey College. Party leaving on tour. Far left, Schuffelen.

1. 11. 11

November 23, 1962. New Zealand.
Massey College. Just before leaving
on tour: I. to R. Gibbs, Robert,
Tavernier.

K-3104

2. 11. 11

November 23, 1962. New Zealand.
Massey College. Party leaving on
tour. Far left, Schmitz.

K-3105



K-3106 November 23, 1962. New Zealand. Massey College. Party leaving on tour.



K-3107 November 23, 1962. New Zealand. Massey College. Party leaving on tour: l. F. W. Walker, r. F. Scheffer.

11111

K-3108 November 23, 1982. New Zealand. Massey
College. Party leaving on tour.

K-3107 November 23, 1982. New Zealand. Massey
College. Party leaving on tour: J. F. W.
Walker, R. F. Scheller.



K-3108 November 23, 1962. New Zealand. Massey College. Party leaving on tour. Tall man right center, A. C. S. Wright.



K-3109 November 23, 1962. New Zealand. Massey College. Party leaving on tour, right, Smith.

IXXIV

IXXV

K-3108 November 23, 1962, New Zealand. Massey College. Party leaving on tour. Tall man of the center, A. C. S. Wright.

IXXVI

K-3109 November 23, 1962. New Zealand. Massey College. Party leaving on tour. Tall man of the center, A. C. S. Wright.

brought along his unwell wife on our tour. She became so ill that she had to go to a hospital in Palmerston North. Her case was diagnosed as hopeless intestinal cancer. Yet he attended all the sessions and the meals at Massey College as if nothing had happened. On Thursday he volunteered a comment on a speaker's discussion of the possible relationship between soils and intestinal cancer as coolly and objectively as anyone.

To bed at 8:10.

November 24 (1): Tea at 7:00 a.m. I caught up on rest even though the hotel was a bit noisy. A short walk and then breakfast.

I go down to look at the waterfront and finish my films. (K-3110, K-3111). Then I spend about 2½ hours in my room on film captions. After lunch I pay my bill, pack, and am ready to go at 3:00 p.m. Certainly, I dislike this New Zealand custom of all shops closed on Saturday.

As I come down the elevator the porter cheers me by the news that three big planes crashed yesterday - one in South Africa, one in France, and one in the United States.

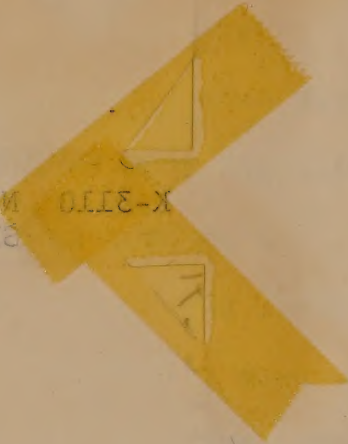
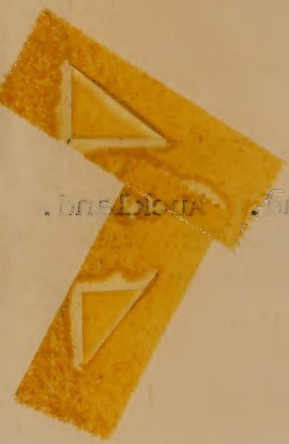
We leave the hotel on the bus and then stop in the air station for weighing and checking. (My overweight baggage is ignored.)



K-3110 November 24, 1962. New Zealand. Auckland.
Ships at wharf.



K-3111 November 24, 1962. New Zealand. Auckland.
Another view of ships at wharf.



K-3110 November 24, 1962. New Zealand. Auckland.
 Ships at wharf.

K-3111 November 24, 1962. New Zealand. Auckland.
 Another view of ships at wharf.

8-1110

8-1111

We are at the airfield at 4:05 and in the air for Fiji at 5:37 p.m. This CPA plane has but few people and I have a tier of seats to myself. I discover that the FAS girls had made an error on my schedules: I am due in Hawaii at 10:00 a.m. not 10:00 p.m. So I should get a good rest tomorrow.

We are down in Nadi, Fiji at 9:30 and in the air again for Honolulu at 10:35. I read a bit and one day passes into another as we cross the dateline and I start another Saturday, November 24.

November 24 (2): Since I can take out the arm rests I lie down and get some sleep.

Breakfast is over at 8:00 a.m. and we are down in Honolulu at 9:45. Customs go quickly and I am in to the Reef Tower Hotel by bus at 10:35.

I wash up, wash my shirts, change and go down to the Pan Am office to check my tickets.

After a light lunch I do a little shopping and some resting.

Supper at 6:00 and to bed at 7:00.

November 25: I am up at 6:00, have breakfast at 7:15 and buy a roll of color film in the hopes of capturing the beautiful view from my window.

I take a long walk on the beach and get a haircut. I feel rested now and am eager to get on home.

The whole of Honolulu is crowded. More new hotels spring up in front of the older ones and cut off their view of the sea. Prices are high plus a stiff sales tax that makes the tourist help pay for the city. All sorts of "Hawaiian" clothes and knickknacks are displayed along the streets for the tourist; and they buy them. I suppose all this costly but cheap kind of living will come to Papeete but I hope not for awhile.

I leave the hotel in a motorcoach at 10:35 and check in a little after 12:00.

Brown, the State Conservationist, comes while I wait. He said he called at both 7:00 and 8:00 last evening but was told that I didn't answer the phone. Well - the phone didn't ring. Then he called this morning and was told I had taken a tour!

I am on the plane at 12:45 and find that every seat is taken. We are in the air at 1:19 which is 3:19 San Francisco time. This is a crowded plane and the girls take a long time for selling drinks. I suppose they get extra for this.

We have our lunch at 5:00 p.m. At 6:15 it begins to be dark. With such a ride I know just how a sardine feels. I saw Efferson and Paarlberg get on in Hawaii and spoke to them briefly. They have been scuffling around in Malaya, and they go first class.

We are down on the runway at 7:45 but kept on the field for half an hour.

I go and check my ticket with United Airlines. The baggage comes in very slowly and the bus is slow in leaving. We get to the city terminal about 9:10. I check in at the Hotel Californian, have a bit of supper, and go to bed.

November 26: I am up at 6:00, have a hurried breakfast, pack and go to the terminal. Although Pan Am didn't charge me overweight, United does. I am on the bus with three minutes to spare and get to the airport at 7:30.

We are in the plane about 8:30 with not many passengers. In the air at 8:44 a.m., which is 11:44 Washington time. I have a nice seat in the back where I can smoke my pipe. The plane goes well but bumpy enough to make our lunch a bit late.

We could have been down early in Baltimore but the pilot couldn't get a strip. The wheels are on the runway about 4:20.

Mommy is there to meet me. We have the baggage at 4:30 and are happily on the road home again, where Joan, Elizabeth, and Stephen are waiting. And Shawn too.

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Cover

A livestock "showcase". A small segment of the Dominion's best beef and dairy cattle, ponies, and horses assembled for the start of the grand parade at the 1961 Royal Show at the Auckland A. and P. Association's Showgrounds, Epsom.

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International Soil Conference

N.Z. Farming's Strength: Depth Scientific Approach to Soil Problems Has Penetrated

PREPONDERANT impression of the majority of the representatives of 34 countries attending the International Soil Conference at Massey University College of Manawatu, Palmerston North, in November last year appeared to be the depth to which the scientific approach to soil problems has penetrated to all levels of the farming community.

THE conference, a joint meeting of Commission IV (Soil Fertility and Plant Nutrition) and Commission V (Soil Genesis, Classification, and Cartography) of the International Society of Soil Science, extended from 13 to 22 November, and was preceded and followed by extensive tours of both the North and South Islands, which embraced a range of soil sites specially prepared by the Soil Bureau and visits to research stations concerned with investigation of soil problems and land utilisation.

"Amazingly Successful"

The conference had been amazingly successful in bringing together the viewpoints of soil scientists, foresters, public health officers, town planners, and, above all, extension workers in agriculture and, through them, farmers, said Mr A. C. S. Wright, now Food and Agriculture Organization of United Nations Adviser in Soils to the Government of Chile, but who for 22 years was with the Soil Bureau of the New Zealand Department of Scientific and Industrial Research, for whom he carried out many of the early soil surveys of the Southland district when he was stationed at Gore.

The conference had naturally dealt with problems at a technical level and farmers were not directly represented, said Mr Wright, but the matters discussed by the wide representation of soil scientists from all over the world would be of interest and significance to farmers when some of the discoveries reported could be translated into practice.

Penetration to All Levels

"To myself, as to a great majority of the overseas workers, the most stimulating feature of the conference programme was the depth to which the scientific approach to soil problems has



A group of the delegates from 34 countries on the Massey College campus, with, inset in front, left to right: Dr J. K. Dixon, recently appointed to succeed Mr N. H. Taylor as Director of the New Zealand Soil Bureau; Prof. Dr G. Aubert, France, President of Commission V; Mr N. H. Taylor, President of the conference; Prof. Dr F. Scheffer, West Germany, who acted as head of Commission IV; Dr A. Stewart, Principal, Massey College; Dr R. B. Miller, Secretary-General of the conference.

penetrated to all levels of the farming community.

"For example, at one of the tour stops in South Canterbury to examine soil profiles, the New Zealand pedolo-

gist described characteristics of the profile; the local Farm Advisory Officer described types of farming and management on the soil types, in extremely precise scientific language, which showed how well he had grasped the true science behind his local problems and conditions.

"He was followed by a soil conservation officer who showed an equally complete grasp of scientific principles of local erosion control. Finally there was a local farmer who even outdid the previous speakers in giving a thoroughly scientific description of his activities.

"This could occur in very few countries outside New Zealand; but if it occurred once during these conference tours, it occurred 20 times.

Close Link with Farming

"Many overseas delegates argued for a long time about this unusual penetration of basic soil knowledge into the farming community," said Mr Wright, "and many were of the opinion that the chief factor must have been the

Monumental Record of Progress in Soil Science

A TOTAL of 105 papers was printed and circulated to members before the International Soil Conference for use as working papers. These, and an additional five papers accepted for publication during the conference, will comprise, with summaries of discussions after every session, the bulk of the "Transactions" of the conference, which are expected to make a volume of between 900 and 1,000 pages and to be published about mid-1963.

sensible way in which scientific discoveries are placed before farmers through agricultural publications, the daily press, radio, etc. As one delegate expressed it, the policy of the Soil Bureau in maintaining the closest possible link with the agricultural world has obviously paid great dividends."

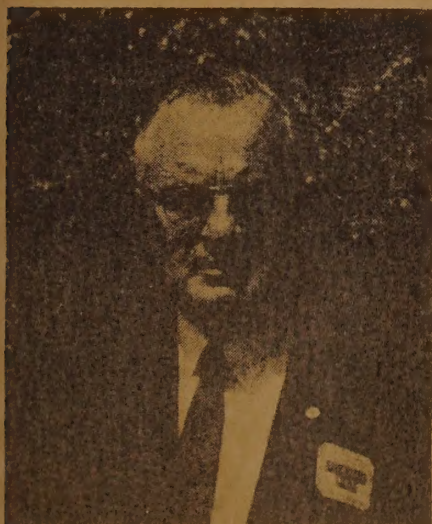
Remarking on the extraordinary change in the appearance of New Zealand's farming landscapes since he worked here, Mr Wright said that in Southland, hills that formerly were either waist high in tussock or sadly scarred by erosion had particularly attracted his attention, because today they are carrying excellent ryegrass-white clover pastures. To delegates on tour the passage of an aeroplane dusting the landscape with fertiliser was an eloquent explanation of the transformation.

N.Z. Approach to Classification

Mr Wright was brought to New Zealand by FAO for the conference because of the great interest overseas in New Zealand soil scientists' approach to the vexed question of soil classification.

"World soil scientists are still largely undecided as to the best criteria for classifying soils, and the New Zealand approach appears to offer a very logical solution to the problem," he said.

Commenting to "The Journal" on the same subject of soil classification, Dr C. E. Kellogg, Assistant Administrator for Soil Survey, Soil Conservation Service, U.S. Department of Agriculture, who gave one of the principal papers in a series of conference sessions in which soil classification systems throughout the world were



Dr C. E. Kellogg, U.S.A.: "World has abundant soil resources if they could be reasonably well used. . . . The challenge to soil scientists is enormous."

reviewed, said that the acid test of a system of soil classification is that it works, and the New Zealand system undoubtedly did that.

"New Zealand was wise," he said, "not to try to adopt the names used in other countries. You have used instead local names for your soils series. If international classification settles down, it will be very easy for

Enduring Lesson to Soil Scientists

REFERRING in his presidential address to the conference to the cooperation and understanding that exist in New Zealand between the soil surveyor and the fertility worker, and between the soil scientist, the agriculturist, the forester, and the engineer, Mr N. H. Taylor said:

"We can claim no great credit for this, for our geographical and political environment is such that anything else would be unthinkable. The initial credit, if credit must be given, goes undoubtedly to a former Director-General of Agriculture, Alfred Cockayne. At a conference in 1930, just after the Soil Survey had been formed, he looked fiercely at the raw recruits and said, 'There is one thing you must learn at the outset. It will serve no useful purpose for you to tell the farmer he should use **potash** if his real need is for **water troughs** to prevent his stock suffering from thirst. Let us then always work together.' Thus was taught a lesson that the soil scientists of New Zealand try never to forget. It transcends departmental and constitutional boundaries and is the secret of the strength of our local soil science society."

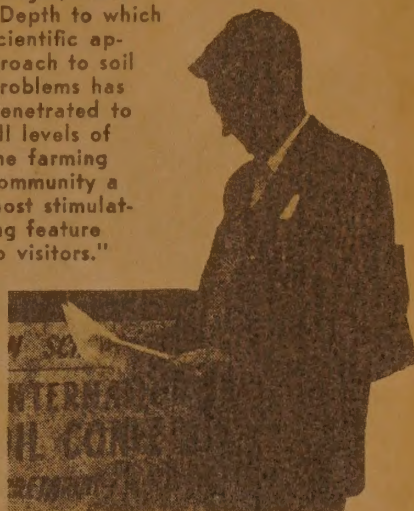
Footnote: A fortnight before the soil conference Mr Cockayne received the New Zealand Grassland Association's 1962 award for "leadership and inspiration in agricultural research and extension during a lifetime of service dedicated to the improvement of New Zealand grasslands."

you to make the necessary adaptations."

Dr Kellogg was in New Zealand in 1949 and was the mover at the Congress of the International Society of Soil Science in Paris in 1956 of the motion that the joint meeting of Commissions IV and V be held in New Zealand in 1962.

INTERNATIONAL SOIL CONFERENCE

Mr A. C. S. Wright, Chile: "Depth to which scientific approach to soil problems has penetrated to all levels of the farming community a most stimulating feature to visitors."



Research-Extension-Farmer Links

There were several reasons, he said, for the good progress made by soil science in the 13 years since he was last in New Zealand. They included the very fine leadership of Mr Norman Taylor, Director of the Soil Bureau and president of the conference, and the fact that the staff working on soil problems is small, so that all know one another, as contrasted with the position in very large countries where leadership works through intermediaries. Relationships between research people in the New Zealand Bureau and advisory people in the Department of Agriculture and with farmers were excellent.

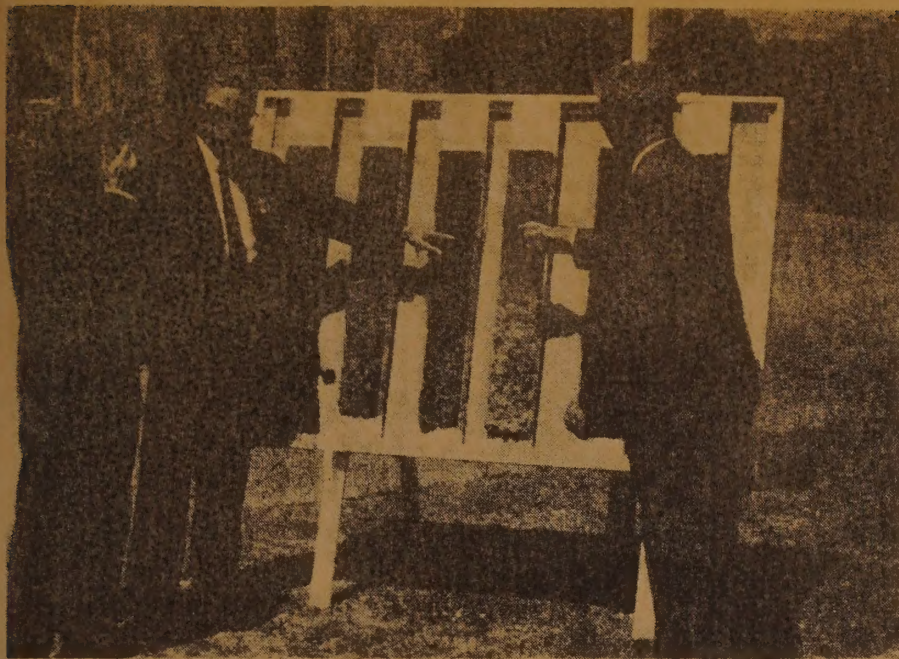
"With soil research," said Dr Kellogg, "the whole thing doesn't pay off until you do something with the farmer. Since I was here 13 years ago there have been enormous advances judging by the attitude of the few farmers I have had the opportunity to meet."

Another advantage New Zealand appeared to have, said Dr Kellogg, was that a high proportion of New Zealand's research and advisory officers appeared to have lived on farms in the first place and understood and could talk with farmers.

In the under-developed countries, on the other hand, the greatest handicaps to efficient soil use were the low social status of the cultivators, the lack of opportunity for an education, and the fact that most government leaders were from towns and knew little about agriculture.

"They simply take it for granted that agriculture is a simple enterprise. We know that nothing could be further from the truth. Even a high proportion of the agricultural advisers and research staffs in the newly developing countries come from towns. They find it extraordinarily difficult to work with the cultivators as fellow-citizens.

INTERNATIONAL SOIL CONFERENCE



Prof. Dr G. Aubert, France, Dr C. E. Kellogg, U.S.A., and Mr N. H. Taylor in animated discussion of part of the display of soil profiles from all parts of the world that were a feature of the conference.

Many of these advisers are sincere and are willing to work and to do things to the cultivators and for them; yet they are unable to work with them. In New Zealand, on the other hand, you have got as nice cooperation right through as I have ever seen.

"In any research organisation there is need for much very intensive study of highly technical matters. Some of the people who are competent to do that are not very good at dealing with

farmers. That doesn't matter if you have some people who can work with farmers; not everybody needs to go on to farms."

N.Z. Steeplands "Special"

Commenting on several papers on steeppland soils, that in New Zealand comprised an unusually high proportion of the land used for farming, Dr Kellogg said it was not generally realised how special the steepplands of

New Zealand are. In many parts of the world steepplands are either too cold or too dry; a great deal of the steeppland in the United States was too dry, and in Scotland it was too wet. In New Zealand, on the other hand, a great deal of the steeppland had a better climate and rainfall than similar country in other parts of the world.

"There seems a little tendency with steeppland in New Zealand to go all to grass or all to trees," he said. "Experience seems to show us that a good deal of rolling and steep land can be mixed, with the more critical parts put to trees and the other parts used for grass. Some should be all trees; grass roots won't hold the slips.

"The results you have achieved on hill country and steeppland in New Zealand are really remarkable—one of the most remarkable things in land development I have seen in my long experience in soil science and its application. I am not sure that it would work everywhere, but there is no doubt about its value in New Zealand."

Soil Science and Man's Future

In both Australia and New Zealand, advances in knowledge of soil fertility and progress with soil classification were the strongest points in the field of soil science, Dr Kellogg considered. "These are the most important things in soil science needed in South-east Asia, and I am a little disappointed that there was not more representation of these countries at the conference.

"To find out what to do with your soils you must find out what soils you've got and their fertility. You can't have progress without that basic knowledge."



One of the bays of the exhibition in the Wool Room at Massey College of New Zealand soils and the results of cooperative research into problems of soils, agricultural, pastoral, and forestry production, soil conservation, engineering, town planning, and human health.

Developing this theme at a public address during the conference, Dr Kellogg said that improvements in soil use during the past 25 years, shown in yields and agricultural efficiency, had been truly phenomenal.

"We can say without fear of contradiction that this is one of the greatest scientific success stories of human history. And the rate of improvement

World Soil Maps

BY the time the next International Soils Conference is held at Bucharest in 1964, the whole world should be covered by soil maps on a scale of 1:5,000,000 to help in the better utilisation of land to feed the hungry of the world.

Progress on the world scheme, which was initiated by the International Society of Soil Science and is being sponsored by UNESCO and the Food and Agriculture Organization, was reported at a special session on the subject at the Massey Conference.

Present was Dr R. Dudal, of Italy, who is responsible in FAO for the coordination of mapping between the different regions.

The mapping scheme was initiated at a world soil conference in 1956, when plans were put forward for the preparation of soil maps covering the great regions of the world.

The International Society of Soil Science decided at its meeting in Madison, United States, in 1960 to ask for help from the specialised agencies of United Nations in preparing an integrated world soil map.

Dr Dudal showed integrated maps of Europe and South America on the scale of 1:5,000,000 (about an inch to 80 miles). These are completed and much of the work for the South-east Asia map has been done. The remainder should be completed by 1964, when the next problem will be to integrate the different legends used on each regional map.

is still accelerating. Somewhat similar advances have been made in forestry and in other uses of our soils. And really we have only begun to put soil science to work."

Remarking that the story was quite different in many of the newly developing countries, and that phenomenal improvements in food production have come mainly on the soils of the temperate regions, Dr Kellogg said that a quick examination of the important food-deficient countries of the world

showed that their problems differed importantly from those commonly worked with in temperate regions, including New Zealand.

"We have learnt something about tropical soils during the past 30 years, and more especially since the Second World War. But the gaps in our knowledge are enormous; much more than most of us realise. Millions of cultivators are now using soils that have never been studied in any way by soil scientists. No one knows where they fit into any system of soil classification detailed enough for management suggestions for individual holdings. Nor is the social environment in many of these countries similar to that of the advanced countries.

"The challenge to soil scientists is simply enormous. Although I recognise the importance of many other phases of agriculture, I am

... INTERNATIONAL SOIL CONFERENCE

willing to assert that unless soil scientists get on with their jobs, and do them well, not much improvement can be expected. We must know what combinations of practices are adapted to each kind of soil."

The question in thinking about a soil anywhere in the world should be not what could be done with it as it was, but how it would respond to sets of management practices, including all the modern machines and chemicals for changing it, and the use of improved varieties of crops with the genetic potential to respond to combinations of practices for high fertility, proper amounts of water, and pest control.

The world actually had abundant soil resources for a greatly increased food supply if they could be reasonably well used.



Appendix I

SOUTHERN TOUR

Rellogg



SOUTHERN TOUR

SOUTHERN TOUR

<u>DAY</u>		<u>TOUR STOPS</u>
(0)	PALMERSTON NORTH - WELLINGTON (Post-meeting tour only)	Soil Bureau, Taita
(1)	CHARTER FLIGHT TO INVERCARGILL	
(2)	INVERCARGILL - ALEXANDRA (or CROMWELL)	Otanomomo Peat Waikiwi Silt Loam Tapanui Forest
(3)	ALEXANDRA - QUEENSTOWN - ALEXANDRA (or CROMWELL) (or CROMWELL)	Conroy Sandy Loam Lowburn Loamy Sand Manorburn Sandy Loam
(4)	ALEXANDRA - OAMARU (or CROMWELL) (or RANFURLY)	Cluden Fine Sandy Loam Waiareka Clay Loam
(5)	OAMARU - ASHBURTON (or RANFURLY) (or TIMARU)	Steward Stony Loam Waikakahi Silt Loam Timaru Silt Loam
(6)	ASHBURTON - LINCOLN (or TIMARU)	Lismore Silt Loam Barrhill Fine Sandy Loam Selwyn Forest
(7)	LINCOLN - WELLINGTON (by ship)	Temuka Silt Loam Taitapu Silt Loam Templeton Silt Loam
	(Post-meeting tour ends at Christchurch)	
(8)	WELLINGTON - PALMERSTON NORTH	Soil Bureau, Taita

SOUTHERN TOUR

PALMERSTON NORTH - WELLINGTON

TOUR NOTES

NORTHERN TOUR

PALMERSTON NORTH - WELLINGTON: 140 miles

Mileage

- 0 Leave PALMERSTON NORTH.

Note remnants of Beech forest on right.

Travel through Manawatu Gorge.

- 9 WOODVILLE

Cross Manawatu and Mangatainoka rivers.

Pass across yellow-brown loams on terrace land developed under 50 in. rainfall.

- 16.5 PAHIATUA

- 33 EKETAHUNA

Cross Makakahi River and climb across yellow-brown earths on hilly land

- 48 MT. BRUCE SADDLE, 1,183 ft (360 m).

Cross Ruamahunga River and on across stony yellow-brown loams on old river terraces.

Note Tararua Ranges on right.

- 67 MASTERTON (pop.)

Centre of Wairarapa Valley, a large agricultural district and headquarters of Catchment Board. 350 ft above sea level, rainfall 38 in.

Follow main highway south across yellow-brown earths developed on terraces.

- 70 Waingawa River.

- 71.5 Inspect Kopua gravelly loam: see separate notes.

- 80 CARTERTON

Cross Waiohine River and proceed across a few miles of recent alluvial soils of high fertility.

Production: butterfat 200 lb/ac/year; $4\frac{1}{2}$ ewes/ac/year; herbage dry matter, 8,00 lb/ac/year.

Mileage

A typical analysis is:

<u>Depth</u>	<u>pH</u>	<u>C</u>	<u>N</u>	<u>C/N</u>	<u>CEC</u>	<u>BS</u>
0-6 in. (9-18cm)	5.5	4.0	0.35	11	19.4	54
8-14 in. (18-36cm)	5.9	4.4	0.15	9	12.8	63

83 Note berry fruit orchards on recent soils from alluvium.

84.5 GREYTOWN

Oldest town in Wairarapa, founded in 1854. Site of first cooperative dairy factory in New Zealand, established in 1881.

85.5 Route passes across stony plains.

87.5 Note stony plains on west, gley soils on east.

88.5 Leave gley soils and travel along Bidwills Hill across yellow-grey earths developed on silts over gravels.

89.5 Inspect Wharekaka silt loam - see separate notes.

94 Pass across gley soils.

98 Note remnant of native broadleaf forest on right on banks of Tauherenikau River. Featherston Dairy Factory on left.

Rejoin main Haighway.

101 FEATHERSTON

Route passes over 15 ft fault trace of 1855 Wellington Earthquake.

101.5 Note grove of black beech (Nothofagus solandri) on left.

Cross Rimutaka Fault Line at river and begin ascent of Rimutaka Range, a fairly recent (Pleistocene) uplifted greywacke block.

Note variation in depth and degree of podzolisation of Rimutaka steepland soils. Has been burnt, sown with pasture species, and reverted to scrub. Best suited for protective forests.

107.5 SUMMIT. 1,820 ft (550,m)

Small areas of red loams can be seen that have developed on intrusions of basic material (spilites).

Mileage

- 114.5 KAITOKE
Animal Research Farm of Dept of Agriculture. Experimental work on cobalt, molybdenum and copper in animals.
- 116.5 Kaitoke Hill. Deep post glacial gravels covered with silts. Small fault line on left road face.
- 117.5 Profile of yellow-brown earth developed from silts in ensilage pit on left.

Terrace on right dislocated by faulting: uplifted and moved north.
- 119 MAORIBANK. Example of red weathering.
- 120.5 UPPER HUTT
Site of Wallaceville Animal Research Station of Dept of Agriculture.
- 123.5 SILVERSTREAM
Note Pinus plantations on left.
- 128.5 TAITA
Site of Soil Bureau, Dept of Scientific and Industrial Research on the Taita Experimental Station - see separate notes.
Lunch stop.
- 130.5 HUTT
- 133.5 PETONE
Site of first European settlement on Wellington Harbour.
- 139.5 WELLINGTON

SOUTHERN TOUR

INVERCARGILL - ALEXANDRA

(or CROMWELL)

TOUR NOTES

Inv./Alex. 1

SOUTHERN TOUR

INVERCARGILL TO ALEXANDRA - 156 miles

Milage

0 Invercargill

2 The Southland Plain is one of the most productive areas of New Zealand. It covers about 800 sq. miles (2000 km²). It is predominantly flat to gently undulating formed on Pleistocene and Recent alluvial terraces covered with 3 to 6 ft (1-2m) of loess.

The soils are mainly yellow-brown earths (fulvic soils) with recent soils and gleys along the floodplains with small areas of peat and podzolised soils. The rainfall is 45" (1140 mm) at Invercargill falling gradually inland. The vegetation was originally red tussock (Danthonia rigida) with patches of podocarp forest. Now much of it is ryegrass - white clover pasture. The farming is predominantly meat (lamb) production usually on single farmer units of about 400 ac (160 ha) carrying 4 ewes/acre. On the best farms 6-7 ewes/acre are carried.

6.5 Enter floodplain of Makarewa River with recent, gley and peat soils.

7 Makarewa Meat Freezing Works, one of 4 in Southland, each processing about a million sheep a year.

Most of these soils are suited to crop production and large areas of turnips and swedes are grown for feeding to sheep. Wheat yields 60-70 bushels/acre (4300 kg/ha
35 cwt/ac).

To the north the Takatimu Mountains rise to 5000 ft (1500 m).

13 Inspect Otanomomo Peat - a raised peat bog. See separate notes.

14 Pass a remnant of the original podocarp forest.

14.5 The Winton Hills on the left are limestone with rendzina soils. On the flat the soils are generally poorly drained and respond well to tile and mole drainage.

17.5 The floodplain of the Makarewa River on the left has heavy textured gley (madentic and luvi madentic) soils with some immature yellow-brown earths (luvi-fulvic soils). A typical analysis (7691) shows:

Horizon	Depth in.	pH	% C	C/N	CEC me. %	B.S. %	Texture
A1	0- 5	4.6	10.4	17	26	46	silt loam
A2	7-11	4.8	5.3	19	21	35	silt loam
B	12-16	5.3	1.9	16	18	53	heavy silt loam
G1	20-24	5.1	0.6	10	25	52	clay loam

19 Remnants of Kahikatea (Podocarpus dacrydioides) swamp forest on right.

26 Note shelter belts, mainly of Cupressus macrocarpa and Pinus radiata.

33 Morton Mains. Region of "Morton Mains Disease" caused by cobalt deficiency. Cobaltised superphosphate now regularly used.

34 *FRAGILE Umbrella*
Inspect Waikiwi Site - see separate notes.

34 Cross more mature gley (madentic) soils associated with Waikiwi soils. Analysis (7690) shows:

Horizon	Depth in.	pH	% C	C/N	CEC me. %	B.S. %
A1	$\frac{1}{2}$ - $4\frac{1}{2}$	4.5	9.4	16	21	40
B	13-19	5.3	3.4	20	12	17
G2	22-28	5.5	0.4	10	8	68

39 Descend from higher terrace into Mataura Valley. On the lower terrace Edendale soils developed on 4 to 6 ft (1-2 m) of loess are younger in age and less developed than the Waikiwi soils. Formerly mainly a dairying district, now it is predominantly fat lamb producing. There is a little wheat growing with yields of 70 bushels/acre (37 owt/ac, 4,700 kg/ha).

41 Edendale. Factory producing lactose from milk.

48.5 Tutarau Native Reserve on right.

50 Mataura. Site of paper mill.

- 53 On the left are the Hokonui Hills, a famous centre (in the early days) of illicit whisky distillation. In this area the rainfall is about 35 to 40 inches (1000 mm), the soils are recent and immature yellow-brown earths (luvi-fulvic). The land is well suited to intensive mixed farming but is used mainly for fat lamb production.
- 61 Gore - an important agricultural centre and grain milling centre, producing cereal foods. Lunch stop.
- 68 Waikaka River - once mined for gold.
- In this area the rainfall is about 35 inches (900 mm). The vegetation was mainly fescue tussock (Festuca novae zealandia) and is now mainly ryegrass-clover pasture used for fat lamb (with some beef) production. The carrying capacity is $3\frac{1}{2}$ -4 ewes/acre and wheat yields 50-60 bushels/acre (29 cwt/ac, 3700 kg/ha). The soils are yellow-grey earths: yellow-brown earth intergrades (fulvi-pallid to palli-fulvic).
- 79 Waikoikoi.
- 81.5 Brief stop for photographs. On the far right is Conical Hills State Forest with the largest sawmill in the South Island. On the face of the Blue Mountains is Tapanui Forest and on the far left Dusky Forest. On the Blue Mountains beech forest (Nothofagus menziesii) occurs in gullies and on south faces with fescue tussock on the drier sunny faces. The soils are steepland yellow-brown earths (clini-fulvic soils) changing at the top to peats (lodic soils).
- 86 Tapanui.
- 94.5 Black Gully Domain. Note afforestation with Pinus radiata and native beech forest.
- 104.5 Start to climb to the Divide into the valley of the Clutha River. The soils here are yellow-grey earth yellow-brown earth intergrades with yellow-brown earths on the steep areas. These steepland soils were formed under silver (Poa caespitosa) and fescue tussock. The lower areas have reverted to manuka and kanaka (Leptospermum spp.) following burning and uncontrolled grazing. The soils are well suited to growing trees but also with some improvement in technology could be used for grazing.
- 109 Raes Junction. In this area farms are 3000-5000 acres (1200-2000 ha) grazing sheep for wool.
- 113 Clutha Valley - rainfall is about 25 inches (640 mm).

at present some 65,000 acres are commanded by water. At present fruit-growing is largely confined to the more fertile soils around Roxburgh, Alexandra and Cromwell where a variety of stone and pip fruit is grown under irrigation. The industry is particularly noted for high quality apricots and cherries. Apart from fruitgrowing, fat lamb farming and wool production are pursued under irrigation in the low rainfall districts and these are supplemented by cash cropping where the rainfall is sufficient (25 to 30 in.) On the native tussock grasslands of the surrounding mountain ranges fine wool is produced.

SOIL DATA

A restricted selection of soil properties, pedological, physical, chemical and biological, has been made from the APPENDICES TO "SOILS OF NEW ZEALAND". This should serve as a basis for soils seen on tours; more detailed information can be obtained from this source.

PEDOLOGY

Only abbreviated profile descriptions are given - full profile descriptions are available in APPENDICES etc. Possible overseas equivalents to New Zealand soil classifications are given on top right hand corner of page with profile description.

MINERALOGY

Values given are approximate percentages of the sand or clay fractions. For the sand fractions, primary minerals only are listed and these are grouped according to silicate structures. For clay fractions, interlayered micas and interlayered chlorites are omitted and sums of percentages do not necessarily approach 100.

CHEMISTRY

The following units are used unless stated otherwise:

milliequivalents per 100 g
oven-dry soil

Cation-exchange Capacity (CEC)
Exch. Ca, Mg, K, Na
Soluble salts

per cent of oven-dry soil

Base Saturation (BS)
C, N

Soil Phosphorus:

Most N.Z. soils respond to phosphate topdressing, and dilute acids extract little or no (available) phosphorus from untopdressed soils. For this reason phosphate-retention figures rather than estimates of available phosphorus have been used. Phosphorus retention is expressed as the percentage of phosphorus retained by 5 g of soil when shaken for 24 hours with 25 mg P in 25 ml of sodium acetate pH 4.6.

Phosphate retention is closely correlated with the Fe and Al extracted by Tamm's acid oxalate reagent, and reflects the distribution of "free" Fe and Al within the soil profile.

SPECTROGRAPHIC ANALYSIS

PHYSICAL PROPERTIES

Interpretation of values reported in APPENDICES TO "SOILS OF NEW ZEALAND" is given; important features only have been selected for comment.

AGRICULTURAL NOTES

These have been contributed by local Farm Advisory Officers of the Department of Agriculture.

DEMONSTRATION TRIALS

Demonstration trials have been laid down by the Department of Agriculture near a number of soil sites, with the purpose of showing how deficiencies of a particular soil may be corrected. Fertiliser responses on grassland are not always obvious to an observer not familiar with visual assessment of pasture; local farm advisors will endeavour to point out any differences showing at the time of the tours.

It should be understood that these plots have not been laid down for research purposes. They are only for DEMONSTRATION. The Farm Advisory Division of the Department of Agriculture conducts about 2,500 field experiments each year; about 1,000 of these are on soil fertility problems. Some are simple pilot trials, but more than half the soil fertility field trials are complex in nature and designed for statistical analysis.

BIOLOGY

A number of major groups of soil organisms have been examined and although the full range of New Zealand soils has not been covered, in some cases sufficient has been accomplished to provide some preliminary generalisations. While there are no universal standard procedures for making biological examinations of soils the methods employed follow, in general, established procedures. The following generalisations have been made for New Zealand soils. Only when soils seen on tours differ from these generalisations is attention drawn to this.

Animals:

The numbers of animals per sq. m. in soil core samples from 0 - 4 cm (0 - 1½ in.) ranged from 800 - 60,000 and from 4 - 8 cm (1½ - 3 in.) ranged from 200 - 22,000. In litter samples numbers per sq. m. ranged from 0 - 14,000.

There is a sequence of changes in soil animal populations paralleling the zonal soil sequence, brown-grey earth --- yellow-grey earth --- yellow-brown earth --- podzols and gley podzols. In the semi-arid grey-brown earths populations are low with mites dominant and collembola rare or absent. With increasing rainfall and the development of yellow-grey earths large and more varied populations develop with mites and collembola constituting an important section. The occurrence of a clay pan restricts movement, particularly the retreat of animals from dessicating conditions. With further increasing rainfall populations increase and in yellow-brown earths there are larger and more varied animal numbers. Excessive rainfall and water-logging of soils, as in podzols and gley-podzols, brings about a decline in animal numbers resulting largely from the increase in anaerobic conditions.

Large and small scale differences in vegetation influence the soil fauna. The change of vegetative cover from forest to grass has a profound influence particularly on earthworms and on the proportion of mites to collembola. Differences are also apparent under grazed and ungrazed grasses which appear to be related to the depth of available animal food.

In general if the organic carbon content of the soil is not low and the C/N ratio is below 15, animal populations are high.

Algae:

Algae occur mainly on the surface of soils, although they also occur at lower levels. In many soils they were found to be rare and no conclusions can be drawn about their distribution. In other soils they varied qualitatively and quantitatively with the pH, concentration of bases and nature of the higher vegetation. The texture of a soil and the parent material from which it is derived have only an indirect effect in creating the algal habitat at the surface.

Green algae (Chlorophyceae) were dominant in acid soils of low base saturation; Diatoms (Bacillariophyceae) were restricted in distribution to those soils either with very high base saturation or where pasture had been established and artificial fertilisers applied; Blue-green algae (Myxophyceae) flourished only on the more alkaline base rich soils although other factors also influenced their distribution. Other classes of algae were also present.

Litter under forest and scrub was unfavourable for diatoms and blue-green algae. When pasture replaces scrub a greater and more varied algal population develops.

Fungi:

Actively growing fungi occur in most soils with non-sporing forms comprising a significant proportion of the population. The type of vegetative cover appears to play a key role in determining the density and species composition of the fungal flora; factors influencing growth of higher plants have an indirect effect on fungal populations.

Lowest numbers of isolations were recorded under forest where Cylindrocarpon species were dominant, intermediate numbers under tussock-grassland where Rhizoctonia species were dominant and highest numbers under good grass-clover pastures where Fusarium species were dominant.

Season appears to have mainly a quantitative effect, the numbers of isolations increasing with temperature, providing the soils remain moist.

High moisture levels tend to lower numbers so that fungi are favoured by warm, moist, well-drained soils.

Yeasts:

Yeasts are present in most New Zealand soils, numbers vary from less than 1,000 to, occasionally, over 500,000 per gram of soil. Numbers are greatest in moist but well drained soils, and drop in soils which are either water logged or drought prone. A few soils contain no yeasts, mainly those subject to a combination of relatively high summer temperatures and low or erratic rainfall.

Three species predominate in soils from the reference sites; Candida curvata which is characteristic of moist soils, Cryptococcus albidus of cool dry soils, and Cryptococcus terreus of warm well-drained soils. Generally all three species can be isolated from all soils but Candida curvata is absent from soils which were treeless in pre-European times and which have had no trees planted on them since.

Actinomycetes:

Actinomycetes are present in most New Zealand soils in numbers ranging from 0 - 14 millions per gram. Streptomyces is the most important genus.

pH is an important factor controlling development, soils with low counts, i.e. below 1 million, are usually below pH 5.6, the lowest count recorded was from a soil pH 3.9 - 4.4. There is also a relationship with higher plant cover. Most low counts are from soils under poor pasture, scrub, fern, tussock grassland and forest, with high counts from soils under good pasture. Low counts are also associated with high C/N ratios.

Podzols and organic soils have low populations, while geologically recent ash showers have a marked influence on the relative distribution of the more widely occurring species.

Climatic mean temperatures do not appear to influence the actinomycete population.

Bacteria:

The bacterial flora of New Zealand soils ranges in numbers from 100,000 to 1 million or more per gram and contains sporeers and biochemically active, fast growing non-sporeers.

The sporeers constitute between 3 and 11% of the population and are dominated by Bacillus megaterium, B. cereus and B. mycoides with B. megaterium tending to be more important in the colder and drier soils.

The non-sporeers are dominant in well established grassland soils and include species of Pseudomonas and Aerobacter.

Protozoa:

Two groups of protozoa have been studied in a number of soils. The Rhizopods or amoeboid forms occur in numbers from 100,000 to 4 million per sq. m. of soil, to 20 million per sq. m. in litter. They are favoured by the accumulation of organic material, are tolerant of acid conditions, and generally are correlated with the organic cycle particularly with mull, mors and peats.

The Ciliate protozoa occur in numbers from 400,000 to 20 million per sq. m. of soil and prefer neutral or alkaline conditions and in general reflect the broad differences of parent material and soil weathering. The ciliates are well represented in intrazonal soils derived from andesite or basalt and less well represented in soils derived from greywacke or rhyolitic pumice.

Soil moisture is an important factor determining protozoan populations.

Weakly developed organic soil of raised lowland bog.
(Lodi-platic soil)

SLOPE AND ASPECT Flat. Slopes W. 1 foot in 2 chain, approx.

VEGETATION OF SITE Sphagnum moss and wire rush (Juncus acutus).

NATIVE VEGETATION Sphagnum moss. Wire rush invaded bog after fire and some drainage. Manuka logs mark transition from swamp peat to raised bog.

PARENT MATERIAL Little-decomposed sphagnum peat on strongly decomposed peat. At 3.5 m (11 ft 6 in.) the peat is underlain by clay, on which rests podocarp logs.

RAINFALL 1000 mm (40 in.) approx.

TEMPERATURE Mean Jan. (summer) 14°C (57°F) Mean July (winter) 4°C (40°F).

ALTITUDE 35 m (110 ft).

LOCATION Wilsons Crossing Road 2 ml. N.E. of Ryal Bush N. side of road and ½ ml. E. of crossroads. G.R. 365210 on S.177. Ref Site No. 51.

HORIZON DEPTH**DESCRIPTION**

0 - 20 cm (0 - 8 in.)	dark reddish brown wet fibrous peat, (D1) mainly sphagnum with many roots of wire rush,
20 - 46 cm (8 - 18 in.)	strong brown to dark reddish brown semi-fibrous peat; (D1 +),
on	dark brown and dark reddish brown peat (D3 - 7).

MINERALOGY OF SAND AND CLAY *Minerals in sand 0.02 to 2 mm

Epidoles	
Pyroxenes	
Hornblendes	
Chlorite	
Biomite	
Muscovite	
Glass	
Andesine	
Acid Feldspar	
Quartz	
Sand %	
Horizon	
Depth	

Constituents of clay less than 0.002 mm

Cristobalite	
Gibbsite	
Halloysite	
Allophane	
Hydrous- feldspar	
Feldspar	
Quartz	
Kaolin	
Mont- morillonite	
Vermiculite-2	
Vermiculite-1	
Interlayered Mica	
Illite	
Interlayered Chlorite	
Chlorite	
Clay %	
Free Fe ₂ O ₃ %	
Horizon	
Depth	

- Notes: (1) Content of minerals very low - 97% loss on ignition of sample from 35 to 43 in. (89-109 cm).
- (2) Inorganic clay amorphous.

* From soil treated H₂O₂ and dithionite; and dispersed 0.02% Na₂CO₃.

CHEMISTRY

Horiz.	Depth	Bulk Dens.	pH	C	N	C/N	CEC	BS	Ca	Mg	K	Na	P Retn.
A ₁ C	0-20cm (0-8in.)	0.04	4.3	48.4	1.43	34	92	30	9.2	14.8	1.07	2.5	0
B ₁ C	20-46cm (8-18in.)		3.8	50.0	0.80	62	112	29	10.2	25.7	0.53	2.7	0
C	49-89cm (18-35in.)		4.0	52.2	0.94	55	109	21	5.9	15.3	0.45	2.3	0

COMMENTS

High levels of Mg and K noteworthy.

SPECTROGRAPHIC ANALYSIS (total element levels)

The formation of organic matter in the absence of mineral acccession has resulted in very low total amounts of all the elements measured. There is a slight accumulation of Mn in the more oxidised layers at the soil surface.

PHYSICAL PROPERTIES

Standard physical measurements not appropriate for this material.

BIOLOGY

Yeasts: Few yeasts present.

Actinomyces: Actinomyces absent.

AGRICULTURE NOTES

The development of peat land is naturally the last to be undertaken and the order of development is directly in relation to the depth of the peat. The peat which has been classified as Otanomomo is that of the raised bogs which are scattered throughout the Southland land district. This is the "wet" peat, and the chief limiting factor in development is to economically drain these bogs so as to permit stocking. Even when partially drained, i.e. the top few inches dried to a limited extent, so as to permit rotary hoeing of the surface, thus peat will grow clover and cocksfoot (Dactylis glomerata), provided lime is applied at about 5000 kg/ha (2 ton/ac) and phosphate at 750 kg/ha (6 cwt/ac).

Development of the shallower edges of these peat areas has been undertaken in various parts of Southland, particularly where overlying marine gravel, and in these situations good ryegrass (Lolium spp), white clover (Trifolium repens) dominant pastures have been established. However, the economic development of the deep peat areas as a farming proposition is not practicable at present. In addition to the lime and phosphate requirements of the developed peat areas, copper has been found a necessary requirement for stock thrift.

Strongly leached southern yellow-brown earth.
(Strongly enleached fulvic soil)

SLOPE AND ASPECT	3°S, smooth convex slope.
VEGETATION OF SITE	Cocksfoot (<i>Dactylis glomerata</i>) and browntop (<i>Agrostis tenuis</i>).
NATIVE VEGETATION	<i>Danthonia rigida</i> in 1840, but earlier probably carried podocarp-broadleaved forest.
PARENT MATERIAL	Loess from basic greywacke and schist. Loess 5½ ft thick overlying weathered gravels.
RAINFALL	1100 mm (45 in.) evenly distributed.
TEMPERATURE	Mean Jan. (summer) 14°C (57°F) Mean July (winter) 4°C (40°F)
ALTITUDE	65 m (210 ft).
LOCATION	Morton Mains, 1 ml. N.E. along road from settlement, west side of road and 117 yds N. of first stream crossing. G.R. 607 123 on S.177. Ref. Site No. 50.

HORIZON	DEPTH	DESCRIPTION	CLAY	SILT	SAND
A ₁	0 - 20 cm (0 - 8 in.)	2.394 4/2 dark greyish brown silt loam; friable to firm; mod. developed medium and fine nutty structure,	28	41	31
AB	20 - 28 cm (8 - 11 in.)	transitional, 2.54R 6/4 dm 5/4 mm			
B ₁ & B ₃	28 - 53 cm (11 - 21 in.)	yellowish brown silt loam; friable to firm; weakly developed fine to very fine blocky structure; few, small soft iron-manganese nodules, 10.9R 0/6	19	42	39
C	on	yellowish brown silt loam; friable to firm; almost massive.	22	41	37

MINERALOGY OF SAND AND CLAY*Minerals in sand 0.02 to 2 mm

Depth	Horizon	Sand %	Quartz	Acid Feldspar	Andesine	Glass	Muscovite	Biotite	Chlorite	Hornblendes	Pyroxenes	Epidotes	Sericite	Plant Opal
0- 8cm (0- 3in)	A ₁₁	46	49	15			5	1	1	3		30	1	1
28-43cm (11-17in)	B ₁	45	39	40			3		1	3	1	30	1	1
51-66cm (20-26in)	C	46	39	5		1	5	1	3	3		30	1	1
Greywackes			35	40		?	15			1		1		

Constituents of clay less than 0.002 mm

Depth	Horizon	Free Fe ₂ O ₃ %	Clay %	Chlorite	Interlayered Chlorite	Illite	Interlayered Mica	Vermiculite-1	Vermiculite-2	Mont- morillonite	Keolite	Quartz	Feldspar	Hydrous- feldspar	Allophane	Halloysite	Gibbsite	Cristoballite
0- 8cm (0- 3in)	A ₁₁	2.2	22*	6	7	6	38	18	25									
24-43cm (11-17in)	B ₁	2.7	31				21	29				6			44			
51-66cm (20-26in)	C	2.0	31				14	18				6			51			

* Allophane not determined in this sample.

Note:- (1) Hornblendes in sand confirm basic greywacke as parent.

(2) Because of parent material quartz in sand is relatively low for weathering stage.

* From soil treated H₂O₂ and dithionite; and dispersed 0.02% Na₂CO₃.

CHEMISTRY

Horiz.	Depth	Bulk Dens.	pH	C	N	C/N	CEC	BS	Ca	Mg	K	Na	P Retn.
A ₁	0-8cm (0-3in.)	1.01	5.3	6.6	0.39	17	17.7	28	3.3	1.3	0.59	0.2	57
	10-18cm (4-7in.)		5.6	4.1	0.29	14	14.4	20	2.0	0.7	0.23	0.2	-
AB	20-28cm (8-11in.)		5.6	2.7	0.19	14	11.5	11	1.0	0.4	0.14	0.1	-
B ₁ & B ₃	28-43cm (11-17in.)	1.21	5.4	1.4	0.13	11	8.5	2	0.4	0.0	0.11	0.1	72
	43-51cm (17-20in.)	1.36	5.5	0.5	0.05	10	7.7	1	0.4	0.1	0.20	0.1	62

COMMENTS

This soil shows a considerable build up of SO₄.

SPECTROGRAPHIC ANALYSIS (total element levels)

The amounts of Cu, Mn, V, are above the normal zonal values and are attributed to the more basic type of greywacke rock. The weathering has been insufficient to result in any major loss of bases.

PHYSICAL PROPERTIES

Clay content is in the medium to low range. Total porosity and macroporosity both decrease with depth from medium high in the topsoil to low at 43 cm (17 in.). Available moisture capacity is high in the topsoil decreasing with depth to low.

BIOLOGY

Animals: Earthworms - Lumbricids dominant under pasture whereas under forest megascolids only were present.

Other animals - Burrows of Tipulidae (Leatherjackets) prominent under forest.

Ratio of mites to Collembola at 0-4 cm (0-1½ in.) depth was 1.6 under forest and 0.1 under pasture.

Algae: Blue green algae absent under forest.

Actinomycetes: Low numbers of actinomycetes under pasture.

AGRICULTURE NOTES

This soil type typifies an area of terrace country lying to the east and north east of the City of Invercargill. The country is watered by the Waihopai and Waikiwi rivers.

Drainage, both tile and mole, is necessary in much of this land, in this connection, outfalls have been facilitated during recent years by the work of the Southland Catchment Board.

A basic requirement of this soil is lime and phosphate which is necessary to stimulate pasture production. Potash is also required, although responses are not always spectacular, but on land that has previously been given application of phosphate, spectacular responses have been recorded. On experimental plots increases in dry matter production have been variously estimated at 1100 kg/ha (1000 lb/ac) for every 100 kg/ha (cwt/ac) of potash applied up to 450 kg/ha (4 cwt/ac). The dry matter of the control plot receiving no potash was 9000 kg/ha (8000 lb/ac).

Potash responses on this soil type are not always sufficiently marked to be observed in plots but when potash is applied in a paddock scale, benefit has been observed in stock thrift.

Cobalt is also necessary on pastures established on this soil, in fact the first evidence of cobalt deficiency in sheep was on farms on Waikiwi Silt loam; the use of cobalt is now general, either applied as an additive to fertilizer, or sprayed on at a minimum rate of 350 g/ha (5 oz/ac) of CoSO_4 .

SOUTHERN TOUR

ALEXANDRA - QUEENSTOWN - ALEXANDRA
(or CROMWELL) (or CROMWELL)

TOUR NOTES

Alex. 1

SOUTHERN TOUR

ALEXANDRA - 138 miles

Milage

- 0 Alexandra.
- 1.5 Observation Point.
- 2 Inspect Conroy soil - see separate notes.
- 7.5 Inspect Lowburn soil - see separate sheet.
- 10 On right is the last gold dredge in Central Otago. It collects about 1 oz of gold per hour.
- 10.5 Plantations of *Pinus radiata*, 30 years old, on right. These are protection forests.
- 12.5 Alexandra - Lunch stop.
- 12.5 Leave Alexandra across bridge and to Earnsclough Rd.
- 15.5 Inspect Manorburn Site - see separate notes.
- 16 Enter Conroy's Gully, a famous goldfield worked mainly by Chinese.
Soils are recent (luvic and siti-luvic) soils from local stream alluvium.
- 18 Cross Fraser River.
- 19 Earnsclough Station of 60,000 acres (24,000 ha) on the range to the left, producing fine wool from merino sheep.
- 21 Clyde.
- 22 Cromwell Gorge.
- 23 On right the Dunstan Mountains (highest peak Leaning Rock, 5,325 ft (1600 m). On left, Cairnmuir Range rising to Cairnmuir, 3,569 ft (1090 m), and Mount Jackson (3,693 ft, 1120 m).
- 32 On left are steep land brown-grey earths (clini sitic soils) showing moderate to severe sheet and gully erosion following fire, overgrazing and rabbit infestation.

An analysis of Alexandra steepeland soils gives:-

Horizon	Depth	pH	%C	C/N	CEC me %	B.S. %	P(Truog)
A	0- 3	6.4	1.2	10	7.1	96	4
B	8-12	6.8	0.6	6	6.8	100	4
C	16-18	8.4	0.3	4	7.2	CaCO ₃ present	3

On the shady faces on the right are steepeland yellow-grey earths (olimi-pallic soils) with slight sheet erosion and a good cover of native tussock grasses. An analysis of Arrow steepeland soils (skeletal yellow-grey earth) gives:-

Horizon	Depth in.	pH	%C	C/N	CEC	B.S.
A	0- 3	6.9	2.0	8	11.8	77
B	4- 8	6.7			9.4	73

- 34 Cross Brewery Creek where Hartley and Riley discovered gold in 1862. In a very cold winter the river was very low and they won 87 lb (40 kg) of gold. In the first five months of the resulting gold rush 70,000 oz, 4,400 lb (2000 kg) were found.
- 35 Cromwell (pop. 940) at the junction of the Kawarau and Clutha Rivers. Rainfall 15 in.
- 38 Ripponvale Irrigation Scheme. Established 1916.
- 39 Kawarau Gorge - 11 miles long.
- 40 Note irrigation works on right.
- 44.5 "Roaring Meg" stream.
Cross 45°S latitude.
The soils through the Gorge are brown-grey earth:yellow-grey earth intergrades. The climate is not as dry as in the Cromwell Gorge.
- 59 Cross Kawarau River.
- 60.5 Enter Arrow basin. Here yellow-grey earths (pallic soils) and associated stony yellow-brown earths (hygrous fulvic soils) are formed on moraines and terraces from the Wakatipu Glacier, covered in part with loess.

- 65 Lake Hayes.
- 68 Cross Shotover River.
- 69 Frankton. The soils are yellow-brown earths (fulvic soils) in a rainfall of about 32 in. (800 mm). These include weakly clay illuvial soils, like the brown podzolics or sol lessive.
- 74 Queenstown. Lake Wakatipu. The lake is 50 miles long and in places over 1200 ft (370m) deep. It occupies the bed of the great Wakatipu glacier.

Across the lake can be seen typical Otago high country with steep land yellow-brown earths (clini fulvic soils) and high country yellow-brown earths (clini elfulvic to elde fulvic). Grazing runs are held in blocks of up to 100,000 acres (40,000 ha) grazing some 10,000 sheep. These soils have suffered widespread deterioration by erosion since the early days when carrying capacities were 2 to 3 times higher.

- 87 Ahead Crown Range and Crown Terrace.
- 89 Arrowtown - early mining town.
- 138 Alexandra.

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CONROY SANDY LOAM

Weakly leached brown-grey earth, with weakly developed claypan.
(Weakly enleached, clay illuvial, sitic soil)

SLOPE AND ASPECT 5°S on gently sloping fan.

VEGETATION OF SITE Scabweed (Raoulia spp), hairgrass (Vulpia dertonensis) scattered clover and thistles.

NATIVE VEGETATION Low tussock grassland.

PARENT MATERIAL Schist loess and solifluction debris.

RAINFALL 330 mm (13 in.)

TEMPERATURE Mean Jan. (summer) 16°C (61°F) Mean July (winter) 2°C (36°F).

ALTITUDE 260 m (850 ft).

LOCATION Observation Hill, east of Alexandra, 50 yd. S. of Alexandra-Little Valley Road. 1.15 mls S.W. from Trig T. Leaning Rock S.D. 2.5 ml. N.W. of Trig U, Cairn Hill S.D. Ref. Site No. 12.

HORIZON DEPTH	DESCRIPTION	CLAY	SILT	SAND	STONES
A ₁ 0 - 8 cm (0 - 3 in.)	dark greyish brown sandy loam; very friable; moderately developed thick platy structure; few fine pores, distinct boundary,	16	24	60	
B ₁ 8 - 41 cm (3 - 16 in.)	yellowish brown silt loam and gravelly silt loam; very friable to firm; structureless; sharp boundary,	19	30	50	1
		8-28cm (3-11in.)			
		17	25	42	16
		28-41cm (11-16in.)			
B _{2cy} 41 - 71 cm (16 - 28 in.)	yellowish brown gravelly sandy loam; firm; weakly developed coarse prisms with dark brown staining on surface; white salt efflorescence,	17	23	60	
		41-61cm (16-24in.)			
C on	pale yellowish brown massive fine sand with thin veinlets of CaCO ₃ . Schist gravels occur at 38 in.				

MINERALOGY OF SAND AND CLAY*Minerals in sand 0.02 to 2 mm

Depth	Horizon	Sand %	Quartz	Feldspar Acid	Andesine	Glass	Muscovite	Biotite	Chlorite	Hornblende	Pyroxenes	Epidotes
0- 8cm (0- 3in)	A ₁	71	38	15			5	1	5	5		15
13-25cm (5-10in)	B ₁	70	44	15			5	1	5	5		15
41-71cm (16-28in)	B _{2cy}	78	50	15			20	20	5	3		15
Schists			30	30			10	5	15	5		5

Constituents of clay less than 0.002 mm

Depth	Horizon	Free Fe ₂ O ₃ %	Clay %	Chlorite	Interlayered Chlorite	Mica Illite	Interlayered Mica	Vermiculite-1	Vermiculite-2	Mont- morillonite	Kaolin	Quartz	Feldspar	Hydrous- feldspar	Allophane	Halloysite	Gibbsite	Crystoballite
0- 8cm (0- 3in)	A ₁	0.5	9	8	11	49	13		8			-	11					
13-25cm (5-10in)	B ₁₁	0.5	10	9	10	52	17		-			5	7					
41-71cm (16-28in)	B _{2cy}	0.7	7		12	62	5	9	10			-	-					

Note: (1) Low clay content and high mica in clay indicate weak weathering.

(2) Quartz in sand of topsoil is lower than that of subsoil indicating possible rejuvenation by loess.

* From soil treated H₂O₂ and dithionite; and dispersed 0.02% Na₂CO₃.

CHEMISTRY

Horiz.	Depth	Bulk Dens.	pH	C	N	C/N	CEC	BS	Ca	Mg	K	Na	P Retn.
A ₁	0-8cm (0-3in.)	1.08	5.8	0.7	0.12	6	5.7	53	2.8	1.0	0.5	0.5	11
B ₁	10-28cm (4-11in.)	1.28	5.4	0.5	0.08	6	4.5	62	2.2	1.0	0.4	0.4	9
	28-41cm (11-16in.)	1.68	8.0	0.3	0.05	6	4.3	98	2.5	0.7	0.1	0.1	9
B _{2cy}	41-61cm (16-24in.)		8.6	0.3	0.05	6	11.6	(100)	10.0	3.4	2.9	2.9	6

SPECTROGRAPHIC ANALYSIS (total element levels)

The composition of the soil horizons indicate that there has been only a slight amount of leaching in the upper horizons.

PHYSICAL PROPERTIES

Clay content low throughout profile. Total porosity, medium in topsoil decreasing to low in subsoil. The presence of stones is associated with a very compact horizon at about 28-43 cm (11-17 in.). Macro-porosity generally medium through the profile. Available moisture capacity generally medium with an increase to high at 61-91cm (24-36 in.).

BIOLOGY

Animals: Animal activity is restricted by climate and low organic matter content. Small granules at 0-1 cm (0- $\frac{1}{2}$ in.) are probably mite pellets.

Algae: Green algae common.

Yeasts: Low numbers of yeasts typical of a cool dry soil.

AGRICULTURE NOTES

The Conroy hill soils extend discontinuously over an area of approximately 30,000 hectares (80,000 acres) within the 300-500 mm (13-20 inch) rainfall area of Central Otago. As sandy - stoney textured soils of generally shallow depth they are very much prone to the effects of the summer drought. Except for small irrigated areas, the agricultural use has been mainly extensive grazing of dry sheep for fine wool production.

When Central Otago was first settled (circa 1850-60's) the vegetation on the Conroy hill soils was a sparse cover of silver and blue tussock, and native grasses, but with overstocking by sheep and rabbits, the vegetation became severely depleted and much erosion (chiefly wind and gully) took place. A secondary vegetative cover developed, which comprised chiefly scabweeds, herbs, introduced weeds and weed grasses, which struggled to cover up the exposed ground. However, since 1950, concentrated rabbit destruction and a policy of restricted grazing has led to a remarkable recovery of the vegetation by natural regeneration. Today many of the shady faces are becoming increasingly clad with tussocks again, while even the more exposed country has more herbs and grasses growing in association with the scabweeds.

The whole of Central Otago has a very low annual return of sulphur with the rainfall and sulphur deficiency of the soil is widespread. The Conroy soil has very low reserves of organic matter. The soil otherwise has a high level of "natural" fertility; i.e., the phosphate, trace element and base status is satisfactory. Of course, in this dry climate, water is the major factor limiting plant growth.

Uses

1. Much of the area will continue to be grazed on an extensive scale for wool production. At present the carrying capacity ranges from 1 sheep to 8 hectares (1 sheep to 20 acres) to 1 sheep to 2 hectares (1 sheep to 5 acres). Where fencing, controlled grazing and provision of stock water, associated with good management is carried out, it can extend the returns of fine wool, and include returns from store sheep.
2. Small areas under irrigation are used for fat lamb and wool production. At present much of the irrigation is by wild flooding - an inefficient method, and the impermeous schist rock close to the surface often leads to waterlogging and inferior rush (Juncus spp.) infested pastures. Under an efficient border-dyking system 8-10 ewes/ha (3-4 ewes/acre) could be carried if provision for winter feed (lucerne hay) is made.
3. Approximately 25 per cent of the area could be improved by the use of conventional dry-land farming practices. This requires the introduction of legumes and grasses into the ground with the minimum of cultivation and maintenance of the pasture through judicious usage of sulphur fertilizers.

- Problems:
1. Conservation of moisture (stock dams and irrigation).
 2. Provision of shelter.
 3. Complete eradication of the rabbit.
 4. Control of sweet briar (Rosa rubiginosa) which is potentially a very serious weed.

Weakly leached brown-grey earth with claypan.
(Weakly enleached, clay illuvial, sitic soil)

SLOPE AND ASPECT Flattish high terrace.

VEGETATION OF SITE Scabweed, Poa maniatoto, sorrel (Rumex acetosa), dandelion
(Taraxicum officinale), festuca tussock.

NATIVE VEGETATION Low tussock grassland.

PARENT MATERIAL Weakly weathered loess and greywacke-quartz-schist alluvium.

RAINFALL 330 mm (13 in.)

TEMPERATURE Mean Jan. (summer) 16°C (61°F) Mean July (winter) 2°C (36°F).

ALTITUDE 220 m (710 ft).

LOCATION Alexandra aerodrome 3.15 ml. N.N.W. of Alexandra, 1.55 ml. S.S.W.
of Trig H, 250 yds N.N.E. of Trig K, Leaning Rock S.D.
Ref. Site No. 13.

HORIZON	DEPTH	DESCRIPTION	CLAY	SILT	SAND	STONES
A ₁	0-10 cm (0-4 in.)	dark grey gritty loam sand; loose structureless; sharp boundary,	8	16	70	6
B ₁	10-41 cm (4-16 in.)	yellowish brown stony coarse sand, loose, structureless. Stones are very weakly cemented together, distinct boundary,	2	5	37	56
B _{2oy}	41-61 cm (16-24 in.)	strong brown stony clay loam, stones cemented together with clay, very firm, massive,	6	9	21	64
C _{ca}	61-66 cm (24-26 in.)	carbonate accumulation in loose, structureless gravels,				
C	on	dark yellowish brown stony slightly loamy coarse sand.				

MINERALOGY OF SAND AND CLAY*Minerals in sand 0.02 to 2 mm

Depth	Horison	Sand %	Quartz	Feldspar Acid	Andesine	Glass	Muscovite	Biotite	Chlorite	Hornblendes	Pyroxenes	Epidotes
0-10cm (0-4in)	A ₁	80	41	15			15	1	15	3		40
43-61cm (17-24in)	B _{2cy}	84	49	40			3	1	5	1		5
69-92cm (27-36in)	C	90	49	40		1	3	5	3			1
Greywackes			35	40		?		15		1		1

Constituents of clay less than 0.002 mm

Depth	Horison	Free Fe ₂ O ₃ %	CLAY %	Chlorite	Interlayered Chlorite	Illite	Interlayered Mica	Vermiculite-1	Vermiculite-2	Mont- morillonite	Kaolin	Quartz	Feldspar	Hydrous- feldspar	Allophane	Halloysite	Gibbsite	Cristobalite
0-10cm (0-4in)	A ₁	0.2	6	3	7	51	22	4	4	5		3	1					
43-61cm (17-24in)	B _{2cy}	0.1	6		21	45	15	5	3	5		3	2					
69-92cm (27-36in)	C	0.2	4	1	8	28	27	1	13	1		2	29					

- Notes: 1. Micas in sand of topsoil exceed micas in greywacke suggesting accessions of loess from schist.
 2. This is supported by worn appearance of the mica particles.
 3. High amounts of angular zoisites (epidotes) suggest accessions of windborne or solifluction material.
 4. Chlorites and high micas in clay indicate early weathering stage.

* From soil treated H₂O₂ and dithionite; and dispersed 0.02% Na₂CO₃.

CHEMISTRY

Horiz.	Depth	Bulk Dens.	pH	C	N	C/N	CEC	BS	Ca	Mg	K	Na	P Retn.
A ₁	0-10cm (0-4in.)	1.46	5.9	2.0	0.13	15	6.1	51	2.0	0.8	0.43	0.1	11
B ₁	13-41cm (5-16in.)	1.79	5.8	0.3	0.03	10	4.0	76	2.1	0.7	0.08	0.0	10
B _{2cy}	43-61cm (17-24in.)		6.6	0.2	0.03	7	9.3	(100)	8.0	2.3	0.16	0.2	11
C	71-91cm (27-36in.)	1.62	7.2	0.1	0.02	5	5.4	(100)	6.1	1.5	0.05	0.1	8

COMMENTS

Total P very low in the subsoil ($\sim 0.02\%$) compared with Conroy Sandy Loam (0.06%).

SPECTROGRAPHIC ANALYSIS (total element levels)

Lower horizons contain lower amounts of alkali metals and alkaline earths than the Conroy soil.

PHYSICAL PROPERTIES

Low clay content. The very high stone content has a considerable influence on the other physical properties. Total porosity is low throughout the profile but macro-porosity is generally high - a common feature in stony soils. Available moisture capacity is low throughout the profile.

BIOLOGY

Animals: Animal activity is restricted by climate and low organic matter content. No earthworms, no collembola.

Yeasts: Low number of yeasts.

AGRICULTURE NOTES

This soil occurs on flat to undulating high terraces and is liable to wind erosion if cultivated. A moderate area of this soil is found in the Maniototo and Vincent Counties. The shallow phases of this soil are not suitable for irrigation. Where water is available, a consistent and steady application is required to establish pasture or lucerne. The irrigation water supply in the area is inadequate, and rainfall is too low for even dryland farming. Stock water races are required on this area to supply water for the few stock that are grazed. The wind erosion has been widespread and soils only support an open cover of weed, grasses and very scattered fescue tussock. A number of areas in the past have been sown with better quality grasses, but have reverted back fairly rapidly. It is being grazed by sheep at a very low stocking rate of about 1 sheep to 2 hectares (one sheep to five acres). Shelter would improve the area and a number of trees have been planted, but growth is extremely slow.

MANORBURN SANDY LOAM

Solonchic soil associated with brown-grey earths.
(Clay illuvial, solonic soil)

SLOPE AND ASPECT 4° S.E.

VEGETATION OF SITE Hordeum spp., Atriplex spp., sorrel (Rumex acetosa).

NATIVE VEGETATION Uncertain

PARENT MATERIAL Loess, etc., on weathered schist.

RAINFALL 330 mm (13 in.)

ALTITUDE 250 m (800 ft).

LOCATION Milne's claim, Chapmans Gully. 2.75 ml. W.S.W. of Alexandra,
.95 ml. W.S.W. of Trig B, Fraser S.D. 300 yds N.N.E. junction
of Chapmans Gully and Conroys roads. Ref. Site No. 53.

TEMPERATURE

HORIZON	DEPTH	DESCRIPTION	CLAY	SILT	SAND	STONES
A ₁	0 - 5 cm (0 - 2 in.)	dark greyish brown sandy loam; friable; weakly developed medium platy structure; abundant small vesicles,	11	23	66	
A ₂	.5 - 10 cm (2 - 4 in.)	olive brown sandy loam; slightly firm; massive,	14	22	64	
B ₂	10 - 30 cm (4 - 12 in.)	sandy loam prisms up to 4 in. diameter with very dark greyish brown coating; hard; prisms break into blocks, faces of which are coated with humus,	16 10-20cm	20 (4-8 in.)	57	7
(II) B ₃ C	30 - 41 cm (12 - 16 in.)	olive and pale grey, micaceous, gritty silt; massive,	13 20-30cm	10 (8-12 in.)	56	21
(II) C	on	pale grey, micaceous, gritty silt; massive; small veins of lime and gypsum.				

MINERALOGY OF SAND AND CLAY*Minerals in sand 0.02 to 2 mm

Depth	Horizon	Sand %	Quartz	Acid Feldspar	Andesine	Glass	Muscovite	Biotite	Chlorite	Hornblendes	Pyroxenes	Epidotes
0- 5cm (0- 2in)	A ₁	71	50	40			15	1	3	1		1
20-30cm (8-12in)	B ₂₂	71	50	40			40	1	3	1		1
38-66cm (15-26in)	IIC	37	>50	1			5		1			1

Constituents of clay less than 0.002 mm

Depth	Horizon	Free Fe ₂ O ₃ %	Clay %	Chlorite	Interlayered Chlorite	Illite	Interlayered Mica	Vermiculite-1	Vermiculite-2	Montmorillonite	Kaolin	Quartz	Feldspar	Hydrated feldspar	Allophane	Halloysite	Gibbsite	Crystobalite
0- 5cm (0- 2in)	A ₁	1.2	11			60					37		3					
20-30cm (8-12in)	B ₂₂	1.7	17	3	7	40	8				40							
38-66cm (15-26in)	IIC	0.3	20			14	8		2		18							

Notes: (1) Kaolin in clay suggests weathering in previous cycle.

(2) High illite indicates early weathering stage in present cycle.

* From soil treated H₂O₂ and dithionite; and dispersed 0.02% Na₂CO₃.

CHEMISTRY

Horiz.	Depth	Bulk Dens.	pH	C	N	C/N	CEC	BS	Ca	Mg	K	Na	P Retn.
A ₁	0- 5cm (0- 2in.)		6.2	1.7	0.17	10	7.1	97	2.9	2.4	0.47	1.0	1
A ₂	5-10cm (2-4in.)	1.32	5.9	1.2	0.13	9	6.1	100	1.5	2.1	0.31	1.3	3
B ₂	10-20cm (4- 8in.)		6.8	0.4	0.07	6	4.9	100	1.5	2.5	0.38	1.3	-
	20-33cm (8-12in.)		7.7	0.2	0.05	4	5.0	100	2.1	3.2	0.31	1.5	-
B ₃ C	33-52cm (12-26in.)	1.61	8.3	0.2	0.04	5	8.0	Free CaCO ₃	5.7	0.26	2.1	-	

SOLUBLE SALTS

Depth	Total	Cl	SO ₄	Ca	Mg	K	Na
0-5cm (0-2in.)	0.24	1.3	1.8	0.1	0.4	0.2	2.1
5-10cm (2-4in.)	0.37	3.2	2.3	0.2	1.2	0.2	3.4
10-20cm (4-8in.)	0.22	1.7	1.8	0.1	0.5	0.2	2.1
20-36cm (8-14in.)	0.24	1.7	2.0	0.1	0.5	0.1	2.9
66-76cm (26-30in.)	1.01	4.1	11.1	5.8	3.3	0.2	6.2

SPECTROGRAPHIC ANALYSIS (total element levels)

This soil has been kaolinised and has higher levels of Al than other soils of the area. Although the soil has been strongly weathered the total amounts of alkali metals and alkaline earths are not low and not markedly different in any horizon.

PHYSICAL PROPERTIES

Clay content is low. Stones are present in the lower horizon at about 10-30 cm (4-12 in.) and are associated with low total porosities. Macro-porosity is medium-high but at 38 cm (15 in.) there are no macropores. Available moisture capacity ranges from high in topsoil to medium in the 10-30 cm (4-12 in.) depth but then rises to extremely high levels due to the nature of the material at the lower depths.

BIOLOGY

- Animals: Animal activity confined to upper horizon by salinity.
- Algae: Films of blue-green algae (Microcoleus and Porphyridium spp) may be seen with the naked eye.
- Yeasts: Low numbers of yeasts probably related to scanty vegetation.

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SOUTHERN TOUR

ALEXANIRA - OAMARU

(or CROMWELL) (or RANFURLY)

SOUTHERN TOUR

ALABAMA - GEORGIA
(or DEPARTMENT OF AGRICULTURE)

TOUR NOTES

Alex./Oam. 1

SOUTHERN TOUR

ALEXANDRA TO OAMARU - 149 miles

Milage

- 0 Alexandra.
- 1 Note stone-fruit orchards, mainly peaches and apricots, on irrigated recent (siti-luvic) soils on fans from the high terrace.
- 11 Chatto Creek - rainfall 14.5 in. (370 mm). The hills on the right are of deeply weathered schist.
- 17 Omakau. (Pop. 210)
- 22.5 Lauder - rainfall 17 in. (430 mm).
- 24 Auroral Research Station of the Dominion Physical Laboratory. Part of a network stretching from Scott Base to the Equator for upper atmosphere research.
- The soils in this area are intergrades between brown-grey earths and yellow-grey earths (siti-pallic soils).
- 28 Becks.
- 29 Cross Manuherikia River.
- 34.5 Inspect the Cluden Soil - see separate notes.
- 39 Pass the divide between the Manuherikia Valley and the Ida Valley, a parallel intermontane basin. The Ida Valley is 30 miles long and 4 miles wide. Farms range from 1000 to 2000 acres (400 to 800 ha) at elevations from 1200 to 1600 ft (350 to 500 m). The growing season is relatively short.

The irrigation scheme in the south end of the valley was installed in 1917.

- 43 An analysis of Struan fine sandy loam gives:-

Horizon	Depth in.	pH	%C	C/N	CEC me %	B.S. %	% Stones
A	0- 3½	5.9	3.5	13	13.4	52	-
B	7-12	5.9	1.5	10	8.0	31	67
pan	18-22	5.8	0.4	5	10.0	21	74
C	23-30	5.5	0.3	6	7.1	20	75

45 Divide between Ida Valley and the Maniatoto Plains.

49 The Maniatoto Plain is the largest intermontane basin in Central Otago. (350 sq. ml. 910 km²) with a soil pattern similar to that of the Ida Valley with brown-grey earths (sitic soils) in the south and yellow-grey earths (pallid soils) in the north.

On the left is Naseby Forest at an altitude of 2000 to 2800 ft (600 to 850 m) with a rainfall of 28 in. (700 mm). In cold winters snow may lie for some weeks. Above the forest are steep land yellow-brown earths which show severe sheet and gully erosion.

57 Ranfurly - Lunch stop. (*after night*)

Ranfurly has a rainfall of 17 in. (430 mm) and its altitude is 1300 ft. (400 m). A large percentage of the Maniatoto Plain grows lucerne (alfalfa) and lucerne hay mixtures, both under irrigation and dry land farming. The carrying capacity on developed dryland farms is 1½ - 2 ewes/acre and on farms with supplementary irrigation 2½ - 3 ewes/acre.

65 Descent into the valley of the Kyeburn which drains the greywacke mountains to the north of the Plains. The cliffs on the left, to the east of the river, are greywacke gravels of late Pliocene and Pleistocene age, covered with thin loess. The soils are yellow-grey earths.

67 Cross Kyeburn River.

76 Examine a yellow-brown earth. See separate notes.

77 Highest point on the Pigroot (2100 ft, 650 m). Descend into the catchment of the Shag River.

Large areas of yellow-brown earths are held in grazing runs of 2000 to 6000 acres (800 to 2400 ha). These are capable of being developed into improved grassland carrying 3 sheep to the acre.

97 Descend into the lower valley of the Shag River.

On the flat land (luvic and palli-luvic soils) there is some cropping, but mainly meat (lamb) production. The soils could be further developed agriculturally although they do suffer from summer drought.

Soils on the downs respond well to lime, superphosphate and molybdenum. The carrying capacity of best farms is 3 to 4 sheep/acre.

107.5 Puketapu Hill ahead.

109 Palmerston.

- 115 On cliffs near the coast the yellow-grey earth soils are strongly "saluviated", i.e. influenced strongly by sea salt which gives black topsoils, deep penetration of humus, and strongly developed domed columnar structures in the B horizons.
- 129 On the left the broken hilly land has yellow-brown earths and yellow-brown earth:yellow-grey earth intergrades on Cretaceous greywacke and sandstone. Land development in this area has not proved very successful largely because of the small area that is ploughable and the difficulty of controlling scrubby vegetation. A large block is now planted in exotic forest (Pinus radiata and Douglas Fir) and this is doing well.
- 134.5 The Downlands stretch through to North Canterbury, bordering higher lands to the west and, in Canterbury, the Canterbury Plains to the east. The Downlands are largely used for meat (lamb) production, wheat and grass and clover seed production. The rainfall in the drier coastal sites is as low as 22 in. (560 mm) and in the foothills as high as 35 in. (890 mm).
- In this area the Downs consist of Pleistocene gravels and loess overlying Tertiary and Cretaceous sediments ranging from basalts and limestones to quartz sandstones and coal measure clays. Most of the soils are yellow-grey earths formed on loess derived from greywacke rocks blown from wide braided river valleys and from the coastal shelf during periods of low sea level. Spectacular responses to fertilisers containing molybdenum have been obtained.
- 141 Inspect Waiareka soil. See separate notes.
- 146 Market gardens on Waiareka soils may be seen on the right - on the left is a block of limestone with rendzina soils.
- Limestone quarries in this area produce building stone and agricultural lime.
- On left Taylors limeworks one of the largest producers of agricultural lime in New Zealand.
- 149 Camaru - Overnight stop.

Southern yellow-grey earth.

(Weakly enleached finely gammate pallic soil, with weak B)

SLOPE AND ASPECT 2°S. on isolated remnant of toe of hill slope.

VEGETATION OF SITE *Danthonia* (*Danthonia* spp), *pilosa*, *Carmichaelia*.

NATIVE VEGETATION *Fescus tussock*.

PARENT MATERIAL Loess and solifluction schist debris over schist gravels.

RAINFALL 650-750 mm (25-30 in.)

ALTITUDE 370 m (1,200 ft).

TEMPERATURE Mean Jan. (summer) 16°C (61°F) Mean July (winter) 2°C (35°F).

LOCATION Devonshire Diggings, Lauder. 2½ mls. N.W. of Trig P. Ref. Site No. 52.

HORIZON DEPTH	DESCRIPTION	CLAY	SILT	SAND	STONES
A ₁ 0 - 20 cm (0 - 8 in.)	very dark greyish brown fine sandy loam; weakly developed fine crumb to medium nutty structure; friable,	18	22	60	
A ₃ + 20 - 43 cm (B) (8 - 17 in.)	olive grey fine sandy loam; moderately to weakly developed medium nutty structure; firm,	15	23	61	1
C _{11x} 43 - 63 cm (17 - 25 in.)	light olive brown fine sandy loam to sandy clay loam with abundant brown and grey mottling,	16	24	59	1
C ₁₂ on	light olive fine micaceous loamy sand.	10	22	66	2

MINERALOGY OF SAND AND CLAY *Minerals in sand 0.02 to 2 mm

Depth	Horizon	Sand %	Quartz	Acid Feldspar	Andesine	Glass	Muscovite	Biotite	Chlorite	Hornblendes	Pyroxenes	Epidotes	Brookite
0- 8cm (0- 3in)	A ₁₁	69	3	30			25	1	1	1		30	
31-43cm (12-17in)	(B)	67	1	30			25	1	1	1		30	1
76-91cm (30-36in)	C ₁₃	71	3	30			25	1	3	1		20	

Constituents of clay less than 0.002 mm

Depth	Horizon	Free Fe ₂ O ₃ %	Clay %	Chlorite	Interlayered Chlorite	Illite	Interlayered Mica	Vermiculite-1	Vermiculite-2	Mont- morillonite	Kaolin	Quartz	Feldspar	Hydrous- feldspar	Allophane	Halloysite	Gibbsite	Cristobalite
0- 8cm (0- 3in)	A ₁₁	1.2	15	7	13	50	18	1	2	3		3	2					
31-43cm (12-17in)	(B)	1.0	17	5	12	52	16	6		5		2	2					
76-91cm (30-36in)	C ₁₃	1.2	10	6	15	40	13	1	25	?								

Note: Sand fractions are unusually high in muscovite and epidote and very low in quartz.

* From soil treated H₂O₂ and dithionite; and dispersed 0.02% Na₂CO₃.

CHEMISTRY

Horiz.	Depth	Bulk Dena.	pH	C	N	C/N	CEC	BS	Ca	Mg	K	Na	P Retn.
A ₁	0-8cm (0-3in.)	1.30	6.4	3.0	0.23	13	10.5	58	3.7	1.7	0.56	0.3	10
	8-18cm (3-7in.)		6.3	1.9	0.16	12	9.7	49	2.8	1.4	0.24	0.3	12
A ₃ ⁺ (B)	18-38cm (8-15in.)	1.39	6.6	1.2	0.10	12	8.3	45	2.2	1.0	0.18	0.3	13
O _{11x}	43-63cm (17-25in.)	1.72	7.6	0.6	0.05	12	7.6	93	3.7	2.0	0.14	0.9	-
O ₁₂	63-91cm (25-36in.)	1.73	9.4	0.2	0.03	7	8.0	100	4.0	2.3	0.16	1.9	3

COMMENTS

Rise in exchangeable Mg and Na in subsoil typical of yellow grey earth.

SPECTROGRAPHIC ANALYSIS (total element levels)

There is very little change in the total element composition of the horizons within the soil profile.

PHYSICAL PROPERTIES

Clay content is low and texture fairly uniform throughout the profile but coarsens somewhat at 25 inches. Total porosity and macro-porosity range from medium in the topsoil to low in the subsoil. Available moisture capacity is generally high.

AGRICULTURAL NOTES

Cluden fine sandy loam is one of the better soils of the dry inland basins of Central Otago. It is derived mainly from loess, is deep and relatively fine in texture. It is subject to seasonal droughts and, on the average, is below field capacity for more than five months of the year and is generally below wilting point for one to five months. Under such conditions ryegrass/white clover pastures are not retained easily, and in fact are found only under irrigation. Cocksfoot/lucerne pastures can be grown under dryland conditions. The B horizon hardpan is a slight barrier to root penetration although it does not greatly retard lucerne growth. Pastures respond well to mixtures of S and P. The nitrogen status is low to moderate.

Cluden fine sandy loam is not intensively farmed, apart from a few small areas under irrigation which produce fat lambs from ryegrass/white clover pastures. Some fodder crops are grown on this soil in moister localities, and some lucerne and lucerne/socksfoot pastures are developed under dryland conditions. But much of the area of these soils supports only extensive sheep grazing on little modified native tussock grassland pastures.

WEHENG A SILT LOAM

Tussock melanised, strongly leached upland yellow brown earth.

(Strongly enleached hygroscopic elfulvic soil from sub-schist)

Brown podzolic. *No*

See next sheet

Trayiscript

SLOPE AND ASPECT Easy rolling.

VEGETATION OF SITE Snow tussock, fescue tussock, dwarf heaths etc.

NATIVE VEGETATION Slightly modified snow tussock grassland.

PARENT MATERIAL Thin cover of loess over sub-schist.

RAINFALL 650-750 mm (25-30 in.)

ALTITUDE 600 m (2,000 ft).

LOCATION Pigroot, $\frac{1}{2}$ mile W. of Shag River, G.R. S135.052.562.

HORIZON DEPTHDESCRIPTION

A 0 - 15 cm
(0 - 6 in.) very dark grey-brown silt loam (light); friable, weakly developed fine granular structure; many roots,

B 15 - 36 cm
(6 - 14 in.) yellowish brown silt loam; very friable; weakly developed fine to very fine nut structure; few roots,

OD 36 - 71 cm
(14 - 28 in.) pale yellowish brown gravelly loam; firm, massive with some fine pores; no roots,

on pale yellowish brown rotten greywacke.

CHEMISTRY

Horiz.	Depth	pH	C	N	C/N	CEC	BS	Ca	Mg	K	Na
A	0-13cm (0- 5in.)	5.8	3.5	0.26	13	15.2	26	1.8	1.4	0.70	0.1
B	23-33cm (9-13in.)	5.1	1.5	0.13	12	10.7	5	0.1	0.1	0.10	0.0
CD	41-51cm (16-20in.)	4.9	1.0	0.10	10	10.1	4	0.1	0.1	0.10	0.0

CLAREMONT SILT LOAM

Tussock melanised, moderately leached, yellow-grey earth.
(Moderately enleached subhydrous pallic soil from
greywacke loess)

Planosol.

SLOPE AND ASPECT	Strongly rolling N facing 15°.
VEGETATION OF SITE	Cocksfoot, some fescue tussock and matagouri scrub, briar and pine trees.
NATIVE VEGETATION	Formerly fescue - silver tussock grassland with associated matagouri scrub.
PARENT MATERIAL	Loess from greywacke.
RAINFALL	650 mm (25 in.)
ALTITUDE	180 m (600 ft).
LOCATION	4½ miles N. of Dunback. G.R. S146.222.381.

HORIZON DEPTHDESCRIPTION

A	0 - 20 cm (0 - 8 in.)	very dark grey brown silt loam (fine sandy); friable, weakly developed very fine to medium crumb structure; many roots,
B ₁	20 - 53 cm (8 - 21 in.)	pale olive brown silt loam; very firm, moderately developed very coarse prismatic structure breaking to coarse blocky structure; many fine pores in peds; pale grey veins between prisms; few roots,
B ₂	53 - 125 cm (21 - 49 in.)	brown to yellowish brown silt loam; very hard, very coarse prismatic structure, prisms massive but with numerous very fine pores,
	on	pale yellowish brown silt loam, very hard and massive.

CHEMISTRY

Horiz.	Depth	pH	C	N	C/N	CEC	BS	Ca	Mg	K	Na
A	0-15cm (0-6in.)	5.5	3.1	0.25	12	14.1	55	4.9	2.3	0.35	0.1
B ₁	42-51cm (17-20in.)	5.8	0.3	0.06	5	12.3	57	3.4	2.7	0.15	0.8
B ₂	76-91cm (30-36in.)	4.9	0.3	0.05	6	12.2	45	1.6	2.4	0.15	1.9
C	125-135cm (50-54in.)	4.9	0.3	0.05	6	11.2	80	0.9	2.9	0.20	2.9

WATAREKA CLAY LOAM

Very weakly leached brown loam
(Very weakly enleached spadi-nigric soil)

SLOPE AND ASPECT	Gently sloping 3° W. On gently undulating landscape.
VEGETATION OF SITE	Cocksfoot (<u>Dactylis glomerata</u>) and fescue (<u>Festuca rubra</u> var. <u>commutata</u>).
NATIVE VEGETATION	Probably silver tussock (<u>Poa caespitosa</u>).
PARENT MATERIAL	Weathered basaltic tuff with small admixture of loess from greywacke.
RAINFALL	600 mm (23 in.)
TEMPERATURE	Mean Jan. (summer) 15°C (59°F) Mean July (winter) 6°C (42°F).
ALTITUDE	37 m (120 ft).
LOCATION	Station Road, Teschemakers. 300 yards W. of Junction with Taipo Road. S136.453.598. 6 miles S.W. of Oamaru. Not Ref. Site.

HORIZON	DEPTH	DESCRIPTION	CLAY	SILT	SAND	STONES
A	0-20 cm (0-8 in.)	black clay; firm; strongly developed fine to medium nut structure; distinct boundary,	63	28	9	
B	20-46 cm (8-18 in.)	brown clay; very firm; moderately developed medium blocky structure; indistinct boundary,	60	27	13	
B ₃	46-69 cm (18-27 in.)	pale olive brown clay; very firm; moderately developed coarse to medium blocky structure with brownish yellow mottled pockets; indistinct boundary,	7	7	84	2
C	cm	pale yellowish brown clay loam mottled brownish yellow; very firm and massive weathered tuff with white flecks and lumps of tuff.				

MINERALOGY OF SAND AND CLAY*Minerals in sand 0.02 to 2 mm

Depth	Horison	Sand %	Quartz	Acid Feldspar	Andesine	Glass	Muscovite	Biotite	Chlorite	Hamblendes	Pyroxenes	Epidotes	Cristobalite- Tridymite
0- 8cm (0- 3in)	A ₁₁	17	50	40		3	1		1	1	-	15	5
18-25cm (7-10in)	B	17	50	40		3	1		1	1	1	15	5
56-81cm (22-32in)	C ₁	87	40	-		1	-		40	-	-	-	20
Basalts					20	5		5		5	15		

Constituents of clay less than 0.002 mm

Depth	Horison	Free Fe ₂ O ₃ %	Clay %	Chlorite	Interlayered Chlorite	Illite	Interlayered Mica	Vermiculite-1	Vermiculite-2	Mont- morillonite	Kaolin	Quartz	Feldspar	Hydrus- feldspar	Allophane	Halloysite	Gibbsite	Cristobalite
0- 8cm (0- 3in)	A ₁₁	1.2	65							100								
18-25cm (7-10in)	B	1.1	68							100								
56-81cm (22-32in)	C	0.3	5							100								

Note:- (1) In topsoil acid feldspars together with glass and ferromagnesian minerals suggests accessions of mixed origin upon an old weathered and chloritised surface.

(2) Montmorillonite is di- and tri-octahedral.

* From soil treated H₂O₂ and dithionite; and dispersed 0.02% Na₂CO₃.

CHEMISTRY

Horiz.	Depth	Bulk Dens.	pH	C	N	C/N	CEC	BS	Ca	Mg	K	Na	P Ret.
A	0-8cm (0-3in.)	0.83	6.4	7.3	0.69	11	77.8	88	42.5	21.1	1.83	0.3	39
	8-15cm (3-6in.)	0.88	6.4	5.4	0.58	9	78.5	86	41.5	20.1	2.66	0.8	45
B	18-25cm (7-10in.)	0.93	6.4	3.4	0.40	9	80.6	86	42.0	20.6	1.83	1.0	53
	30-46cm (12-18in.)		7.0	0.8	0.20	8	79.4	77	40.0	18.7	2.88	2.1	18
B ₃	56-69cm (22-27in.)		7.1	0.2	0.04	5	114.0	98	61.3	31.6	10.2	8.3	32

COMMENTS

Very high levels of exchangeable Mg and K. In the B₃ horizon K is at a level of 10 me% and occupies approximately 10% of the C.E.C. - exchangeable Na is also high. These high levels are associated with the presence of chlorite in this horizon instead of acid feldspars.

Adsorbed S is low because of the high pH.

SPECTROGRAPHIC ANALYSIS (total element levels)

The basic nature of the parent rock has resulted in high levels of Cr, Ni, Co, Fe, Mg in the soil.

PHYSICAL PROPERTIES

Figures available show high clay content down to 25 cm (10 in.) but at 58-81 cm (23-32 in.) sand predominates. Total porosity and macro-porosity are respectively high and medium-high, while available moisture capacity is high.

BIOLOGY

- Animals: Highest total animal population of any soil examined. Included Psuedococcidae and associated fungal hyphae and considerable numbers of psuedoscorpions typical of forest soils.
- Yeasts: Low population of yeasts Cryptococcus albidus L variant dominant.
- Bacteria: High numbers of Aerobacter.
- Protozoa: Moderate numbers of protozoa.

AGRICULTURAL NOTES

Reaching almost to the southern boundary of the town of Oamaru is a tract of flattish to rolling downland country which is dominated by a rather striking limestone escarpment. The rich, highly fertile soils of this region are known locally as the "tar soils" a name which has arisen no doubt from the black nature of the soil and its stickiness when wet. Available phosphate is high. Of recent years the need for sulphur on these soils has been widely demonstrated by numerous trials and this element has played a major part in the pasture improvement now apparent over the region.

In spite of cultivation difficulties, this soil is capable of very high production and is intensively farmed with a good deal of diversification. The physical features are such that the soil is "gluey" when wet and in drought periods, cracking to a width of 10 cm (4 in.) and a depth of 1 m (3 ft) is not uncommon.

Since 1945 much of the flatter country has gradually been utilised for market gardening, and here the Chinese community have developed a substantial industry, concentrating on the production of brassicae, carrots, lettuce and early potatoes. Land not so utilised is farmed, and here fat lamb production, grain growing and small seed production feature largely in the economy. The farm size averages under 80 hectares (200 acres) and may carry up to 7 ewes/ha (3 ewes/ac) besides undertaking some cereal production. Wheat yields of 7,000 kg/ha (100 bu/ac) are not uncommon.

Town supply dairying is also a feature of these soils on which the growing of lucerne for hay and for grazing, and roots such as mangolds and fodder beet, for supplementary feed, is practised.

The area is short of surface water supplies and until recently underground bores and rain water were chiefly relied upon. In 1961 most of the area came under the Weston water scheme, which is one of the many rural water schemes which serves most of the rolling downlands of North Otago. The downlands lie west of the Waiareka clay soils.

The market price of land in this region has reached as high as £300 and some of the market gardeners are paying as high as £20 per acre rent.

SOUTHERN TOUR

OAMARU - ASHBURTON
(or RANFURLY) (or TIMARU)

TOUR NOTES

Oam./Ash. 1

SOUTHERN TOUR

OAMARU TO ASHBURTON - 136 miles

Milage

- 0 Oamaru.
- 4 Inspect Waiareka Demonstration Plot.
- 10 The coastal plain soils are fertile, weakly leached, yellow-grey earths (pallio soils). These soils are suitable for market gardening and intensive mixed farming.
- 13 Pukeuri.
- 14 The Waitaki Plains are formed of Pleistocene gravels carried by the Waitaki River which drains a large section of the east side of the Southern Alps. As the river is largely snow fed it has high summer and low winter flow. On it a series of lakes and hydro-electric stations are being built, the latest of which is Benmore, 70 miles up river which will produce 540,000 kilowatts.
- 19 Inspect Steward Demonstration Plot.
- 26 Inspect Steward soil - see separate notes.
- 28 Cross Waitaki River. Area of Redcliffs Irrigation Scheme of 4,600 acres commenced 1936.
- 38 On left the Waikakahi Homestead, once centre of a 47,000 estate.
- 40 Inspect the Waikakahi soil and Demonstration Plot. See separate notes.
- 42 Cross Waihao River. The alluvial soils on the floodplain of the Waihao River come from a catchment containing greywacke limestone and glauconitic rocks. The soils are used for mixed farming with potatoes as a main crop. An analysis is:

Depth	Horizon	pH	%C	C/N	CEC me %	B.S. %	Ca	K me %
0- 6	A	5.2	3.5	9	23.0	58	8.4	1.0
12-18	B	5.9			15.0	71	6.7	0.4

48 Waimate. (Pop. 3,000).

54 Lunch stop.

71 Timaru downlands, a block of early Pleistocene gravels covered with a thin sheet of dolerite. On the dolerite is a covering of middle and late Pleistocene loess varying in thickness from about 20 to 50 ft (6 to 15 m). The rainfall at the coast is 23 in. (580 mm) rising inland to 35 in. (890 mm) in the foothills. The native vegetation was tussock grassland. The soils (Timaru set) are the modal yellow-grey earths (drier hygroscopic pallic soils) of New Zealand.

Farms vary about 350 ac. and are used for intensive farming based on meat (lamb) production, cereal cropping and pasture grass and clover seeds.

79 Adair Soil Conservation Reserve.

81.5 Inspect Timaru soil - see separate notes.

84 Timaru. (Pop. 25,000). Port and agricultural centre for South Canterbury. Settled in 1859. Area of Levels Irrigation Scheme, covering 12,800 acres commenced in 1937.

88 Southern end of the Canterbury Plains. They stretch 120 miles (200 km) to the north and are 40 miles wide in mid Canterbury. They are formed of a series of coalescing gravel fans laid down in late glacial times. Between the fans and along the coastal margin are recent sediments of the present day rivers.

The high gravel fans (up to 1500 ft, 450 m., in places near mountains) which slope at about 40 ft/mile (8m/km) to the sea are covered by a very thin layer of loess, usually less than 15 in. (40 cm) thick, but ranging up to 10 ft (3 m) in thickness near the Rakaia and other rivers where loess is still accumulating. The alluvial soils of the post-glacial period vary widely in texture and depth to the gravels, but are frequently more than 3 ft (1 m) to the gravels.

99 Temuka. The road crosses a low lying part of the plains between two rivers. The soils are recent (luvic) and recent-gleys (luvi-madentic) with small areas of peats (platic). They are used for fat stock, dairying for town milk supply, and some cropping.

105 On left the Four Peaks and Mount Peel Ranges rising to 5,700 ft (1700 m).

113 Cross the Rangitata River.

From this river 1,000 cusecs of water are diverted above the 1,000 ft contour, into the Rangitata Diversion Race which is 42 miles long and runs north to the Rakaia River. The water is used for irrigation in

three districts which cover some 198,000 acres, with a net irrigable area of 130,000 acres, of which 32,000 acres are already border dyked. The water is not stored at any stage. The full capacity of the diversion race can be used for generating electric power at the lower, northern, end of the race at Highbank on the banks of the Rakaia River. This is done in winter when electric power demand is high and irrigation demands non-existent.

Farms vary about 800 - 1000 acres and are used mainly for meat (lamb) production and some cropping.

136 Ashburton. Overnight stop.

STEWART STONY SANDY LOAM

18.1

Moderately leached stony soil associated with yellow-grey earth.
(Moderately enleached clay illuvial stony fulvic soil)

*Melained Podzol or
Brown Podzol
with extensive
aerenchyma.*

SLOPE AND ASPECT Flat terrace land (sample site on slightly higher part).
VEGETATION OF SITE Fescue (Festuca rubra), sweet vernal (Anthoxanthum odoratum).
NATIVE VEGETATION Formerly fescue tussock grassland (silver tussock (Poa caespitosa)
may also have been present).
PARENT MATERIAL Moderately weathered greywacke alluvium - stony gravels and
sands (late Pleistocene).
RAINFALL 500 mm (20 in.)
TEMPERATURE Mean Jan. (summer) 16°C (61°F) Mean July (winter) 6°C (42°F).
ALTITUDE 35 m (110 ft).
LOCATION 1½ mls. S.W. Waitaki-Steward Road, 50 yds S. of high terrace on
East side of road. G.R. S128.629.842. Ref. Site No. 18.

HORIZON DEPTH		DESCRIPTION	CLAY	SILT	SAND	STONES
A ₁	0 - 20 cm (0 - 8 in.)	very dark greyish brown stony sandy loam; friable, moderately developed very fine nutty structure,	n.d.*	n.d.	n.d.	65
B ₁	20 - 41 cm (8 - 16 in.)	brown gritty stony sandy loam; firm to friable; moderately developed fine nutty structure,				
B ₂	41 - 79 cm (16 - 31 in.)	dark reddish brown stony gravels with gritty sandy loam matrix, stones coated with dark reddish brown silty clay; very hard, massive and very coherent between 28-31 in.	n.d.	n.d.	n.d.	81
C ₁	on	stony gravels with gritty sandy matrix; firm; massive and slightly coherent.				

* not determined.

MINERALOGY OF SAND AND CLAY*Minerals in sand 0.02 to 2 mm

Depth	Horizon	Sand %	Quartz	Acid Feldspar	Andesine	Glass	Muscovite	Biotite	Chlorite	Hornblendes	Pyroxenes	Epidotes	Sericite
0- 8cm (0- 3in)	A ₁₁	61	43	50			1	1	1	1		15	5
46-61cm (18-24in)	B ₂	78	46	50			1	1	1			5	3
69-76cm (27-30in)	B _{3x}	92	50	15									15
Greywackes			35	40		?		15		1		1	

Constituents of clay less than 0.002 mm

Depth	Horizon	Free Fe ₂ O ₃ %	Clay %	Chlorite	Interlayered Chlorite	Illite	Interlayered Mica	Vermiculite-1	Vermiculite-2	Mont- morillonite	Kaolin	Quartz	Feldspar	Hydrus- feldspar	Allophane	Halloysite	Gibbsite	Cristoballite
0- 8cm (0- 3in)	A ₁₁	1.2	16	9	18	22	26	2	12			6	4					
46-61cm (18-24in)	B ₂	0.8	10	9	10	18	31	2	12				8					
69-76cm (27-30in)	B _{3x}	1.6	4	12	19	22	22	2	6			6	12					

* From soil treated H₂O₂ and dithionite; and dispersed 0.02% Na₂CO₃.

CHEMISTRY

Horiz.	Depth	Bulk Dens.	pH	C	N	C/N	CEC	BS	Ca	Mg	K	Na	P Retn.
A ₁	0- 8cm (0- 3in.)	n.d.*	5.2	9.2	0.67	14	26.8	53	8.4	3.8	1.04	0.2	34
	8-16cm (3- 6in.)	n.d.	5.3	4.7	0.37	13	18.6	48	5.3	2.7	0.49	0.2	37
B ₁	23-36cm (9-14in.)	n.d.	5.6	4.3	0.28	15	21.0	28	3.6	1.7	0.28	0.2	53
B ₂	46-61cm (18-24in.)	n.d.	5.8	4.8	0.30	16	18.7	21	2.9	1.3	0.11	0.2	87
	69-76cm (27-30in.)	n.d.	5.7	2.9	0.17	17	14.4	10	1.2	0.5	0.06	0.1	80

* n.d. = not determined.

COMMENTS

It should be noted that analyses are made on the < 2 mm fraction.

In the subsoil Tamm's soluble Al is greater than Tamm's soluble Fe - both are high.

SPECTROGRAPHIC ANALYSIS (total element levels)

There is little differentiation in the amounts of elements in the horizons freed of stones but there is probably an accumulation of Mn above the B horizon.

PHYSICAL PROPERTIES

Stone content very high. Comment not possible since no undisturbed core samples were taken.

AGRICULTURE NOTES

A few miles north of Oamaru lies the triangular Waitaki Plain, a major soil of which is the Steward stony sandy loam. This soil varies from medium to low fertility and the maintenance and improvement of this fertility evolves around the use of lime, superphosphate and the introduction of clover and grass species such as subterranean clover (Trifolium subterraneum), white clover (Trifolium repens), ryegrass (Lolium spp), cocksfoot (Dactylis glomerata).

Subterranean clover is a most useful pioneer plant, for once established it is capable of high seasonal production which enables heavy stocking which is a prerequisite for any fertility build-up programmes.

In the unimproved state the vegetative cover is dominantly a browntop (Agrostis tenuis), chewings fescue (Festuca rubra var. commutata), danthonia (Danthonia spp), hairgrass (Vulpia spp), sweet vernal and flat weed sward which is capable of at the most, supporting 2 ewes/ha (1 ewe to two acres). This figure under efficient dry land farming can be raised to 4 ewes/ha (1½ ewes/ac) and on some farms where irrigation is available, 8 ewes/ha (3 ewes/ac) can be carried. Whilst the topography of this area suggests its suitability for irrigation, the presence of a pan at varying depths of 30-60cm (12 to 24 in.) in varying regions is a problem which would be of major consideration.

Pasture life, being of relatively short duration, necessitates an active rotation in which rape (Brassica napus) for lamb fattening and soft turnips (Brassica campestris) for winter feed, feature greatly. Farms are in the 800-1200 acres size range, and up to 250 acres may be under cultivation. From the very nature of the soil, wear on implements is great.

Some brassicae seed and grass and clover seed production is done, but in the main farm income is from sheep in the form of fat lambs, store lambs and wool.

Wherever possible, farmers are endeavouring to establish lucerne stands.

WAIKAKAHI SILT LOAM

Pedocalcic soil associated with yellow-grey earths
(Very weakly enleached palli-nigric soil)

SLOPE AND ASPECT	4° N.W.
VEGETATION OF SITE	Cocksfoot (<u>Dactylis glomerata</u>), yarrow (<u>Achillea illefolium</u>), and Californian thistle (<u>Cirsium arvense</u>).
NATIVE VEGETATION	Silver tussock; no local knowledge of native forest except in neighbouring swamps.
PARENT MATERIAL	Marl (highly calcareous fine sandstone) and minor loess.
RAINFALL	6,000 mm (23 in.)
TEMPERATURE	Mean Jan. (summer) 60°F (16°C) Mean July (winter) 41°F (5°C)
ALTITUDE	150 m (500 ft).
LOCATION	Valley Road, Waiaho Downs 3 ml. south of McCullough's Bridge. Ref. Site No. 19.

HORIZON	DEPTH	DESCRIPTION	CLAY	SILT	SAND
A	0-30 cm (0-12 in.)	dark greyish brown silt loam; friable; moderately developed fine granular structure merging to coarse and medium nutty structure,	30	20	41
B ₂	30-43 cm (12-17 in.)	dark greyish brown clay loam; firm; moderately developed coarse nutty structure,	32	35	33
B _{3oa}	43-76 cm (17-30 in.)	pale olive brown heavy silt loam; firm; weakly developed medium blocky structure; few to many, prominent calcareous flecks and streaks,			
C _{1ca}	on	pale olive brown fine sandy loam; massive; highly calcareous.			

MINERALOGY OF SAND AND CLAY *Minerals in sand 0.02 to 2 mm

Depth	Horison	Sand %	Quartz	Feldspar Acid	Andesine	Glass	Muscovite	Biotite	Chlorite	Hornblendes	Pyroxenes	Epidotes	Sericite	Calcite
0-15cm (0- 6in)	A ₁	56	30	30			5		5	1		20	5	1
28-41cm (12-16in)	B ₂	57	30	30			5		5	1		20	5	-
56-86cm (22-34in)	C _{11ca}	65	30	20			1		3	1		10	-	3

Constituents of clay less than 0.002 mm

Depth	Horison	Free Fe ₂ O ₃ %	Clay %	Chlorite	Interlayered Chlorite	Illite	Interlayered Mica	Vermiculite-1	Vermiculite-2	Mont- morillonite	Kaolin	Quartz	Feldspar	Hydrous- feldspar	Allophane	Halloysite	Gibbsite	Cristoballite
0-15cm (0- 6in)	A ₁	2.0	23		3	36	23	12		26		2						
28-41cm (12-16in)	B ₂	2.0	21	2	13	31	19	9		23			3					
56-86cm (22-34in)	C _{11ca}	1.6	14	2	5	18	25	12		21		2	3					

Note:- (1) Levels of chlorite and illite in clay indicate relatively early development stage.

(2) Montmorillonite characteristic of rendzinas has some interstratification with clay-vermiculite.

* From soil treated H₂O₂ and dithionite; and dispersed 0.02% Na₂CO₃.

CHEMISTRY

Horiz.	Depth	Bulk Dens.	pH	C	N	C/N	CEC	BS	Ca	Mg	K	Na	P Retn.
A	0-15cm (0-6in.)	1.18	6.6	4.6	0.35	13	22.3	93	17.2	2.4	1.45	0.2	15
	15-28cm (6-11in.)		7.3	1.6	0.18	9	17.9	84	12.8	1.5	0.75	0.2	-
B ₂	30-41cm (12-16in.)	1.42	7.6	1.3	0.16	8	17.8	94	14.8	1.1	0.60	0.2	-
B _{3ca}	43-56cm (17-22in.)		8.0	0.9	0.09	10	14.5	(100)	?	?	0.20	0.2	-

SPECTROGRAPHIC ANALYSIS (total element levels)

A high amount of the bases Ca, Mg, Na, K, Ba, Sr, is present in all the soil horizons. The elements Zr and Cr are also above normal.

PHYSICAL PROPERTIES

Clay content is medium becoming low between 16 inches and 23 inches. Total porosity is medium in the topsoil but becomes low below about 4 inches. Macroporosity remains medium throughout the profile. Available moisture capacity is high to 6 inches, medium at lower depths.

BIOLOGY

Bacteria - Low numbers of Aerobacter.

Protozoa - Relatively low numbers of protozoa.

Levels of total and adsorbed S are both low and explain why this soil is S deficient.

AGRICULTURE NOTES

The Waikakahi silt loam, though limited in area, is one of the most fertile soils of the downlands of South Canterbury. Ca, P and K are usually high and with the exception of P which sometimes gives a slight response in pastures or brassica crops, no responses are obtained with the other elements. There is however, a deficiency of S in the soil and clovers and lucerne respond well to applications of this element.

The normal topdressing practice on pastures is to apply 200-225 kg/ha ($1\frac{1}{2}$ -2 cwt) superphosphate every second year which gives quick results under favourable growth conditions. Increasing use is being made of mixtures of elemental S in conjunction with superphosphate but it is slower acting.

Cu is known to be marginally deficient in this soil but there is little evidence as yet that it affects stock thrift.

With a warm dry climate - the average rainfall is about 6000 mm (23 in.) per annum but extremely variable - the soil is ideally suited for fat lamb production and mixed cropping. On the highest producing farms 6-7 breeding ewes/ha ($2\frac{1}{2}$ -3 breeding ewes/ac) plus replacements in some cases, are carried. Good percentages of lambs are drafted fat off the mothers and the remainder fattened on rape.

Wheat does extremely well and yields of up to 6000 kg/ha (90 bu/ac) are not uncommon although the average yield would be about 4000 kg/ha (60 bu/ac). The steepness of some of the country makes harvesting with modern equipment difficult, and this precludes a larger area being grown.

Pastures are sown with a mixture of perennial ryegrass (Lolium perenne), cocksfoot (Dactylis glomerata), montgomery red clover (Trifolium pratense) and white clover (Trifolium repens) and with good management will remain high producing for 5 to 7 years. Crops of grass or clover seeds are often harvested in favourable years.

The control of high fertility weeds such as barley grass (Hordeum mucinum) and Nodding Thistles (Cardus nutans) is a problem in pastures while californian thistles (Cirsium arvense) is difficult to control in brassica crops.

TIMARU SILT LOAM

Moderately leached yellow-grey earth.
(Moderately enleached gammate pallic soil
from moderately argillised loess)

SLOPE AND ASPECT 5°S, smooth convex slope of South Canterbury downlands.

VEGETATION OF SITE Twitch grasses (Agropyron spp.).

NATIVE VEGETATION Silver tussock (Poa caespitosa).

PARENT MATERIAL Moderately weathered greywacke loess.

RAINFALL 600 mm (23 in.)

TEMPERATURE Mean Jan. (summer) 16°C (61°F) Mean July (winter) 5°C (41°F).

ALTITUDE 60 m (200 ft).

LOCATION Gleniti, Timaru; Morgans Rd., 300 yds North from Timaru-Claremont Rd. G.R. 746528 on S.111. Ref. Site No. 8.

HORIZON DEPTH	DESCRIPTION	CLAY	SILT	SAND
A ₁ 0 - 30 cm & A ₃ (0 - 12 in.)	very dark greyish brown silt loam; friable; moderately developed medium to fine crumb and weakly developed fine nutty structures; numerous roots; distinct boundary,	19	43	38
B ₂ 30 - 64 cm & B _{3g} (12 - 25 in.)	yellowish brown silt loam; firm; weakly developed medium to fine blocky structure; yellowish brown clay skins on some peds; weakly developed reticulate strong brown mottling in lower part of horizon, few roots; indistinct boundary,	18	40	42
CX on	yellowish brown silt loam; hard; strongly developed very coarse columnar structure; cracks between columns filled with soft structureless pale yellow silt; indistinct boundary.			

MINERALOGY OF SAND AND CLAY*Minerals in sand 0.02 to 2 mm

Depth	Horizon	Sand %	Quartz	Acid Feldspar	Andesine	Glass	Muscovite	Biotite	Chlorite	Hornblendes	Pyroxenes	Epidotes	Pumpellyite	Plant Opal
0-10cm (0-4in)	A ₁₁	62	39	40		1	1		1	1	1	10	1	5
30-46cm (12-18in)	B ₂₁	50	46	40		1	1		1	1	1	20	1	1
61-90cm (24-36in)	CX	53	41	40		1	1		3			20	1	1
Greywackes			35	40		?		15		1		1		

Constituents of clay less than 0.002 mm

Depth	Horizon	Free Fe ₂ O ₃ %	Clay %	Chlorite	Interlayered Chlorite	Illite	Interlayered Mica	Verdauite-1	Verdauite-2	Mont- morillonite	Kaolin	Quartz	Feldspar	Hydrus- feldspar	Allophane	Halloysite	Gibbsite	Cristobalite
0-10cm (0-4in)	A ₁₁	1.3	14	3	9	26	42					4	3					
30-46cm (12-18in)	B ₂₁	1.4	16	-	7	34	37	2				2	1					
61-90cm (24-36in)	CX	1.6	13	-	4	37	20	10				2	4					

- Note: (1) Low mica content of sand.
 (2) Pyroxenes, hornblendes and glass may indicate minor contributions from loess from ash.
 (3) Plant opal throughout profile may indicate steady continuous accumulation.

* From soil treated H₂O₂ and dithionite; and dispersed 0.02% Na₂CO₃.

CHEMISTRY

Horiz.	Depth	Bulk Dens.	pH	C	N	C/N	CEC	BS	Ca	Mg	K	Na	P Retn.
A ₁	0-10cm (0-4in.)	1.01	4.1	4.6	0.33	14	17.2	47	5.0	3.4	0.60	0.6	19
	10-23cm (4-9in.)	1.24	4.7	2.3	0.18	13	13.9	40	3.5	2.3	0.25	0.6	25
	23-30cm (9-12in.)		5.4	1.1	0.10	11	11.1	50	3.2	2.4	0.25	0.6	22
B ₂	30-53cm (12-21in.)	1.68	5.8	0.65	0.06	10	11.0	44	2.7	2.2	0.20	0.6	25
CX	66-91cm (26-36in.)		5.3	0.40	0.04	10	11.8	28	1.5	1.6	0.15	0.7	28

COMMENTS

Mg/Ca increases steadily down the profile although Mg does not increase.

Total S very low in the subsoil.

SPECTROGRAPHIC ANALYSIS (total element levels)

There is a tendency for higher amounts of Al and Fe in the lower horizons but there is very little consistent trends with depth for the other elements analysed.

PHYSICAL PROPERTIES

Clay figures are medium throughout the profile, the texture being somewhat coarse for a yellow-grey earth. Total porosity figures decrease from medium in the topsoil to very low in the subsoil. Macro-porosity is general medium low. Available moisture capacity ranges from high in the topsoil down to 23 cm (9 in.) to medium in the subsoil.

BIOLOGY

Animals: A wide variety of kinds of animals present.

AGRICULTURE NOTES

This soil is of medium fertility. Its P levels are low and its exchangeable K and Ca levels medium. Topdressing with superphosphate is necessary and in the initial stages of development dressings of 2500-4000 kg/ha (1-1½ tons/ac) of lime are required thereafter being reduced to approximately 2500 kg/ha (1 ton/ac) every 5-6 years (which coincides with pasture renewal). Potash application gives occasional responses but they are usually slow to become evident (3-4 years).

Much of the soil is in permanent pasture (5-8 years) which has raised the soil's naturally low humus content and improved its moisture holding capacity.

It can become waterlogged in extremely wet seasons but the rainfall is normally well distributed. Excessive drying during the summer is more important than wet conditions in winter, hence moisture conservation in summer is more beneficial than drainage in the winter and spring. Because of the weak topsoil structure sheet erosion can take place on cultivated fields after very heavy rain.

Holdings are mainly 80-200 hectares (200-500 acres). Wheat yields up to 5000 to 5500 kg/ha (70-80 bu/ac) (with an average of 3000-3500 kg/ha (40-50 bu/ac)) are obtained and the carrying capacity is approximately 5-6 ewes/ha (2-2½ ewes/ac). The soil is ideal for mixed cropping/fat lamb production and a very wide range of crops can be grown. These include small seeds (clover and ryegrass), rape and turnips (for lamb fattening and winter feed respectively) and a very wide range of cash crops including cereals and linseed.

SOUTHERN TOUR

ASHEURTON - LINCOLN
(or TIMARU)

SOUTHERN TOURASHBURTON TO LINCOLN - 113 miles

Milage

0 Ashburton.

11 Inspect Lismore soil at Winchmore Irrigation Research Station - see separate notes.

The farms average 400 to 600 acres (150 to 250 ha) in area and usually one-third to one half is irrigated. The irrigated land is used mainly for meat (lamb) production and carries 4-5 sheep/acre.

Without irrigation the land is used for sheep with supplementary fodder crops for fattening (turnips, rape, kale, oats, barley and an increasing area of lucerne). With good management it carries 3 sheep to the acre. Normally little wheat is grown but higher prices are making it more attractive at present and the area is increasing.

When first settled in the 1860's and 1870's after subdivision of the big runs the soils under tussock grassland were ploughed and continuously cropped with cereals. The fertility declined and there was extensive wind erosion. Gradually short term pastures were introduced and cropping was done in rotation. In the 1930's lime was used, legumes were established and fertility improved. Now using DDT superphosphate (DDT for grass grub control) and good management the fertility has become so high that crops of wheat of 40 bushels/acre (21 cwt/ac, 2700 kg/ha) can be obtained.

24 Inspect the Barrhill soil - see separate notes. Lunch stop.

34 Cross the Rangitata Diversion Race. The top of the intake to the Highbank Hydroelectric Station can be seen on the right.

36 Approach the hills, the highest point of which is Mt Hutt (7,180 ft, 2150 m). Note the presence of shelter belts. In this area north-westerly gales sweep down the relatively confined Rakaia Gorge and shelter is essential for cultivation and stock protection. These gales are typical föhn winds arising from prevailing westerlies that rise over the Alps precipitating their moisture on the western slopes. To the east they are dry and warm.

42 Short stop before descending to the river. In this area the rainfall is about 45 in. (1150 mm) and the altitude 1500 ft (450 m). On the lower terraces there are wind blown alluvial soils similar to the Barrhill, but more leached.

- 46 "Fighting Hill" ahead. When cold fronts coming up the plain from the south meet gales coming down the gorge from the north west there is much turbulence and heavy cloud formation.
- The overall problem in this area is low nitrogen supply, as phosphate, sulphur and molybdenum are all low and limit growth of legumes.
- 50 Note the stony bouldery soils. Here the increased drainage of shallow stony soils gives yellow-brown earths in an area of yellow-grey earth: yellow-brown earth intergrades.
- 51 Windwhistle. The soils here are similar to the Lismore soils but the rainfall is higher and the soils do not dry out in summer.
- 52 Selwyn Plantations. Short stop.
- 55 Steeles Road Forest. Short stop.
- 77 Watsons Forest. Short stop.
- 78 Homebush Station. This farm is part of the original Homebush Estate of 33,000 acres established in 1851. In 1878 was carrying 12,000 sheep and had own coal mine and pottery works.
- 84 Darfield.
- 113 Lincoln.

Stony soil associated with yellow-gray earth.
(Moderately enleached copallic fulvic soil)

SLOPE AND ASPECT	Flat terrace on main Canterbury Plains.
VEGETATION OF SITE	Sweet vernal (<u>Anthoxanthum odoratum</u>), and catsear (<u>Hypochaeris</u> spp.).
NATIVE VEGETATION	Silver tussock.
PARENT MATERIAL	Moderately weathered greywacke loess on gravels.
RAINFALL	700 mm (28 in.)
TEMPERATURE	Mean Jan. (summer) 16°C (61°F) Mean July (winter) 4°C (40°F).
ALTITUDE	170 m (550 ft).
LOCATION	Winchmore Experimental Station, Ashburton. Special reference pit in back paddock. Ref. Site No. 15.

HORIZON DEPTH	DESCRIPTION	CLAY	SILT	SAND	STONES
A ₁ 0 - 15 cm (0 - 6 in.)	very dark greyish brown silt loam with occasional greywacke stones; friable to firm; moderately developed medium and fine nutty structure and occasional granules,	24	30	45	1
B ₁ 15 - 38 cm (6 - 15 in.)	olive brown silt loam with occasional stones; firm; moderately developed medium and fine blocky structure,	17	35	47	1
B ₂ 38 - 51 cm (15 - 20 in.)	olive brown gravelly sandy loam; very firm; moderately developed fine nutty structure between stones,	8	13	28	51
O _m 51 - 84 cm (20 - 33 in.)	olive stony sandy loam to loamy sand; massive; weakly cemented; stones with dark brown discoloration,				
on	pale olive gravelly sand and stony gravels, loose with little staining.				

MINERALOGY OF SAND AND CLAY*Minerals in sand 0.02 to 2 mm

Depth	Horizon	Sand %	Quartz	Acid Feldspar	Andesine	Glass	Muscovite	Biotite	Chlorite	Hornblende	Pyroxenes	Epidoes	Sericite
0- 8cm (0- 3in)	A ₁	54	39	40			1		3			5	3
30-38cm (12-15in)	B ₁	51	39	50			1		3			5	3
Greywackes			35	40		?		15		1		1	

Constituents of clay less than 0.002 mm

Depth	Horizon	Free Fe ₂ O ₃ %	Clay %	Chlorite	Interlayered Chlorite	Illite	Interlayered Mica	Vermiculite-1	Vermiculite-2	Mont- morillonite	Kaolin	Quartz	Feldspar	Hydrus- feldspar	Allophane	Halloysite	Gibbsite	Cristoballite
0- 8cm (0- 3in)	A ₁	0.8	17	18	18	26	15	8	12	3								
30-38cm (12-15in)	B ₁₂	0.8	20	19	21	28	12	9	9	2								

Note: The distribution of species in the clay fraction is fairly characteristic of the weathering zone.

* From soil treated H₂O₂ and dithionite; and dispersed 0.02% Na₂CO₃.

Horiz.	Depth	Bulk Dens.	pH	C	N	C/N	CEC	BS	Ca	Mg	K	Na	P Retn.
A ₁	0-8cm (0-3in.)	1.16	5.0	3.8	0.27	14	13.6	38	3.4	1.5	0.76	0.1	27
	8-15cm (3-6in.)	1.33	5.3	2.8	0.22	13	12.0	31	2.3	0.7	0.52	0.1	30
B ₁	15-38cm (6-15in.)	1.52	5.6	1.4	0.13	11	10.0	30	1.8	0.9	0.32	0.1	31
B ₂	38-48cm (15-19in.)		6.0	0.6	0.07	9	9.8	28	1.7	1.2	0.10	0.1	39
C _m	51-66cm (20-26in.)		5.9	0.6	0.07	9	6.6	17	0.7	0.4	0.08	0.0	45

COMMENTS

Total S and adsorbed sulphate are both low.

Although exchangeable Mg is low the reserves of Mg are high.

Mo is low in this soil.

SPECTROGRAPHIC ANALYSIS (total element levels)

Copper levels are very low compared with most non-loessial soils from greywacke.

PHYSICAL PROPERTIES

Clay content is generally medium to low. High stone content at 15 inches and below. Total porosity generally medium to low. Macro-porosity is medium high in the topsoil decreasing to medium in the subsoil. Available moisture capacity is high down to 15 inches.

Lismore Silt Loam is the typical soil type of the farming land commonly known as "Canterbury Light Plains". In an undeveloped state, it is low in fertility, being deficient in Calcium, Phosphorus and Sulphur. pH is frequently as low as 5.1. Pastures quickly revert to weed grasses, mainly brown-top (Agrostis tenuis), hairgrass (Vulpa spp), and sweet vernal (Anthoxanthum odoratum). Clovers do not thrive and carrying capacity is about 2-3 ewes/ha (1 ewe/ac).

Very little of this soil type has not now been improved by initial liming to bring it up to a pH of 5.8+, maintenance liming at 2500 kg/ha (1 ton/ac) every 7-8 years and regular topdressing with superphosphate. Under this treatment, subterranean, white and red clovers thrive. Fertility improves and carrying capacity can be built to three ewes per acre under good management. Dry matter production from good pasture will vary between 3500-9000 kg/ha/yr (3000-8000 lb/ac/yr) depending on the amount and spread of the rainfall from September until May.

Potash topdressing does not normally give pasture responses. Molybdenum response is slight. Boron is commonly applied for the prevention of brown heart in swedes. The soil type is thought to be borderline in copper levels for stock health but copper is not normally given. Treatment with Selenium has consistently given live-weight and wool responses in sheep.

Present management involves some cash cropping with wheat, oats, barley and linseed together with a small amount of grass-seed production, but the total area of cash crop rarely amounts to more than 1/10 of the farm area in any one year. Wool and fat lambs amount for by far the greater proportion of the returns. Periodic droughts - soil moistures are below optimum for between two and four months in most years - are the main limiting factor and necessitate the carrying of large feed reserves in the form of lucerne hay. A considerable area of this soil type is now under irrigation which raises its carrying capacity by approximately 5 ewes/ha (2 ewes/ac).

Recent soil from slowly accumulating loess
(Weakly enleached fulvi-volic soil)

Regosolic

SLOPE AND ASPECT Flat terrace of Canterbury plains.

VEGETATION OF SITE Cocksfoot, (*Dactylis glomerata*), *Poa protensis*. Oak trees 4 m (15 ft) away.

NATIVE VEGETATION Silver tussock. (*Poa caespitosa*)

PARENT MATERIAL Accumulating loess derived from greywacke. Current accumulation 0.2 mm/year.

RAINFALL 750 mm (30 in.)

TEMPERATURE Mean Jan. (summer) 16°C (60°F) Mean July (winter) 5°C (41°F).

ALTITUDE 210 m (700 ft).

LOCATION Barrhill village "square", 15 chains from edge of terrace on south bank Rakaia River. Ref. Site No. 7.

HORIZON DEPTH	DESCRIPTION	CLAY	SILT	SAND
A ₁ 0 - 36 cm (0 - 14 in.)	dark greyish brown fine sandy loam; very friable; moderately developed fine granular and some weak medium nutty structures; abundant roots; indistinct boundary,	19	33	48
B 36 - 61 cm (14 - 24 in.)	pale olive brown fine sandy loam; few indistinct brownish yellow mottles; friable weakly developed fine nutty structure; many fine pores; indistinct boundary,	13	33	54
C _{1m} 61 - 91 cm (24 - 36 in.)	pale olive brown fine sandy loam with occasional brownish yellow discontinuous vertical streaks; massive and weakly coherent,			
on	pale olive brown loess with greywacke gravels at 1.8 m (6½ ft).			

MINERALOGY

Epidotes	Amphiboles	Chlorite	Biotite	Muscovite	Glass	Acid Feldspar	Quartz	Horizon	% Sand
15	< 1	5	-	3	< 1	15	37	A	70
5	-	3	-	< 1	< 1	15	31	B	69
5	< 1	3	-	< 1	< 1	5	34	C	-
1	1		15		?	40	35	Greywacke	

Quartz	Interlayered Chlorite	Chlorite	Interlayered Micas	Vermiculite 2	Illite	Horizon	% Clay
-	-	15	-	25	60	A	8.3
4	-	30	6	-	60	B	7.6
-	5	20	-	10	65	C	11.2

- Notes: (1) Epidotes are high and acid feldspars low relative to typical parent rock. Suggests wind and water sorting may have caused redistribution of minerals of parent rock prior to weathering.
- (2) High chlorite and illite in clays indicate early weathering stage.

CHEMISTRY

Horiz.	Depth	Bulk Dens.	pH	C	N	C/N	CEC	BS	Ca	Mg	K	Na	P Ret
A ₁ }	0- 8cm (0- 3in.)	1.16	4.9	4.0	0.31	13	14.6	72	7.4	2.1	0.96	0.1	20
	8-20cm (3- 8in.)	1.28	5.5	2.7	0.21	13	9.8	47	3.0	1.1	0.49	0.0	25
(B)	36-61cm (14-24in.)	1.39	6.0	0.8	0.09	9	5.0	46	1.8	0.6	0.12	0.0	21
C _{1m}	61-91cm (24-36in.)	1.55	6.3	0.5	0.06	8	5.2	64	2.5	0.6	0.15	0.0	16

COMMENTS

Total S is rather low and follows the level of organic matter (C and N) fairly closely. Adsorbed sulphate is very low as is sulphate-adsorption capacity, especially in the presence of phosphate.

Reserves of Mg (especially) and K are exceptionally high.

Total P higher than for other soils of Canterbury Plains.

SPECTROGRAPHIC ANALYSIS (total element levels)

The amounts of the bases Ca, Mg, Na, K, Ba, Sr are moderately high in all horizons with a slight lowering of the amounts in the upper horizons. In this soil from greywacke loess the copper content is about half that of weakly weathered soils formed from greywacke rocks.

PHYSICAL PROPERTIES

Clay content is low throughout profile decreasing slightly with depth. Total porosity is medium low in the topsoil becoming low below 3 inches. Macroporosity is low but increases slightly to medium below about 14 inches. Available moisture capacity is high to 8 inches then decreases to medium.

BIOLOGY

Yeasts: Cryptococcus albidus dominant

Actinomycetes: High percentage of population

AGRICULTURAL NOTES

Barrhill Fine Sandy Loam is a medium fertility soil well adapted to cropping because of its free working nature and early spring growth. A relatively low water-holding capacity makes it susceptible to summer drought and makes it difficult to utilise fully with livestock alone. Although cash crops are not particularly high yielding -

Wheat	30 - 40q/ha	(45 - 55 bu/ac)
Barley	30 - 35q/ha	(50 - 60 bu/ac)
Peas	20 - 25q/ha	(30 - 40 bu/ac)
Potatoes	200 - 250q/ha	(8 - 10 ton/ac)
Ryegrass	450 - 900kg/ha	(20 - 40 bu/ac)
White Clover	100 - 200kg/ha	(100 - 200 lb/ac)

cheap cultivation, easy harvesting and good quality make cash cropping a profitable enterprise. On typical farms, up to half the farm area is harvested for crops of these and other cash crops. In addition, a stocking rate of approximately 5 ewes/ha (two ewes per acre) is maintained over the whole farm area and all lambs are fattened.

Spring sown crops respond to applications of phosphorus but only small pasture responses are obtained to Ca, P, S and Mo. Truog P tests are high. Symptoms of Manganese deficiency were observed in wheat in 1957 and have recurred in all but one season since. Symptoms generally occur in patches in paddocks, leaves showing chlorotic streaks and a more prostrate growth habit. Symptoms appear to be more pronounced where lime applications have been heaviest. Responses of up to 7q/ha (10 bu/ac) to spray applications of $MnSO_4$ have been recorded.

Dry matter production from pasture is highly variable, being dependent on spring and summer rainfall. From good pasture, it may be as high, in a favourable year, as 110q/ha (10,000 lb/ac) or as low as 45q/ha (4,000 lb/ac) in a drought year. Lucerne is grown for hay production.

D.D.T. applications are essential for pasture maintenance, both grass-grub (Costelytra spp) and PORINA (Oxycaenus spp) being destructive. The saving of pasture seeds, grass and clover seeds, an important aspect of management on this soil, is conducive to considerable damage from pasture pests, in particular from Porina.

TOUR NOTES

Linc.

SOUTHERN TOUR

LINCOLN

Milage

0 Lincoln College.

Inspect Temuka soil - see separate notes.

Inspect Lincoln College Farm.

Lunch.

Leave Lincoln College.

On left, Crop Research Division and Botany Division of the Department of Scientific & Industrial Research.

Cross a complex of poorly drained (madentre) soils in the lower areas and imperfectly drained soils on the levees. Mainly used for dairy farming for city milk supply with some cropping e.g. malting barley, wheat, peas.

3 Inspect Taitapu soil and demonstration plot - see separate notes.

Note farms using spray irrigation.

10 Prebbleton.

11.5 Inspect Templeton soil and demonstration plot - see separate notes.

13 Cross Main South Highway and Main Trunk Railway.

18 Inspect Selwyn soil - see separate notes.

31 Lincoln College.

Pre-conference Tours

Return to Lincoln for dinner.

Travel by bus to Lyttleton and board Steamer Express for Wellington.

Post-conference Tours

Tour concludes in Christchurch.

100

100

100

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100

100

Weakly leached gley soil.
(Weakly enleached clay illuvial madentic soil)

SLOPE AND ASPECT Flat in swampy depression at toe of major gravel fan.

VEGETATION OF SITE Mixed pasture species - never ploughed; ryegrass (Lolium spp), white clover (Trifolium repens), yorkshire fog (Holcus lanatus); Poa spp.

NATIVE VEGETATION Swamp vegetation - raupo (Typha augustifolia), rushes (Juncus), toitoi (Arundo richardii).

PARENT MATERIAL Greywacke alluvium resting at 33 in. on an old peaty soil.

RAINFALL 640 mm (25 in.)

TEMPERATURE Mean Jan. (summer) 16°C (61°F) Mean July (winter) 5°C (41°F).

ALTITUDE 12 m (40 ft).

LOCATION Lincoln College Farm; towards N.E. corner of paddock S.E.1. which has never been ploughed. Ref. Site No. 10.

HORIZON DEPTH	DESCRIPTION	CLAY	SILT	SAND
A 0 - 23 cm (0 - 9 in.)	black silt loam, slightly firm; strongly developed coarse blocky breaking to medium and fine nuts; many roots,	34	43	23
GB 23 - 43 cm (9 - 17 in.)	grey silty clay, many distinct coarse reddish yellow and strong brown mottles; root channels which have a pale brown lining; very firm; prismatic structure,	43	43	9
GC 43 - 76 cm (17 - 30 in.)	grey silty clay loam; plastic but not sticky, many reddish yellow and strong brown mottles.			

MINERALOGY OF SAND AND CLAY*Minerals in sand 0.02 to 2 mm

Depth	Horizon	Sand %	Quartz	Acid Feldspar	Andesine	Glass	Muscovite	Biotite	Chlorite	Hornblendes	Pyroxenes	Epidotes	Sericite	Plant Opal
0- 8cm (0- 3in)	A ₁₁	32	50	50	-	1	1	-	1	-	-	1	5	15
18-28cm (7-11in)	AB _g	14	50	50	-	-	1	-	1	1	-	1	1	3
Greywacke			35	40		?	15			1		1		

Constituents of clay less than 0.002 mm

Depth	Horizon	Free Fe ₂ O ₃ %	Clay %	Chlorite	Interlayered Chlorite	Illite	Interlayered Mica	Verdiculite-1	Verdiculite-2	Mont- morillonite	Kaolin	Quartz	Feldspar	Hydrus- feldspar	Allophane	Halloysite	Gibbsite	Cristobalite
0- 8cm (0- 3in)	A ₁₁	0.7	28	2	15	46	20	2	13			2						
18-28cm (7-11in)	AB _g	1.8	30			50	13	4	21	2		9	3					

Note: Clay contains high amount of illite showing state of weak weathering.

* From soil treated H₂O₂ and dithionite; and dispersed 0.02% Na₂CO₃.

Horiz.	Depth	Bulk Dens.	pH	C	N	C/N	CEC	BS	Ca	Mg	K	Na	P Retn.
A	0-8cm (0-3in.)	0.93	6.2	8.3	0.70	12	34.0	97	23.5	4.7	2.42	0.2	11
	8-15cm (3-6in.)	1.11	6.5	5.1	0.45	11	27.6	100	19.0	4.3	1.64	0.4	14
AB _g	18-28cm (7-11in.)		7.1	2.5	0.25	10	19.3	100	13.6	5.7	0.96	0.5	-
GB	28-43cm (11-17in.)	1.41	-	0.6	0.08	8	15.9	100	11.0	7.3	0.38	1.0	14

SPECTROGRAPHIC ANALYSIS (total element levels)

The topsoil has a lower level of basic elements K, Na, Mg than the gleyed AB horizon. Copper has concentrated in the zone above the gleyed horizon. The total amounts of Mn and Co are low in this soil.

PHYSICAL PROPERTIES

Clay content is medium increasing to high at about 11 inches. Total porosity is medium in the topsoil, low in the subsoil. Macro-porosity generally is low while available moisture capacity is high.

AGRICULTURE NOTES

Temuka silt loam is a heavy soil of medium fertility on which the full potential use is frequently limited by lack of adequate drainage and a high water table. Without artificial drainage the extent of cropping is limited and pasture production reduced. The two types of farm common to this soil type are dairying and fat lamb raising with a limited amount of spring-sown cash crops and small seed production. Owing to wet conditions over the winter, the amount of autumn-sown wheat is limited. Potatoes are rarely grown on this soil type. The area of peas is limited. Barley is the most favoured crop. Contrary to expectations lucerne does reasonably well except on the wettest parts.

Pastures respond to Ca and also to P. Spring-sown crops respond to P.

Typical yields for cash crops are wheat 2500-4500 kg/ha (35-65 bu/ac), barley 2500-4000 kg/ha (45-70 bu/ac), peas 1500-3000 kg/ha (20-45 bu/ac). Small seed yields are substantially reduced on this soil in dry seasons but would range from - ryegrass (Lolium spp) 350-1000 kg/ha (15-45 bu/ac), white clover (Trifolium repens) 80-350 kg/ha (70-300 lb/ac). On a typical sheep and mixed farm of this soil type, carrying capacity would be 5-6 ewes/ha (2 to 2½ ewes/ac) with one-sixth in small seeds. On a dairy farm on this soil, there would be 35 to 40 milking cows and replacement stock per 40 ha (100 acres), a paddock of barley, and in favourable seasons a paddock in a small seed crop. Butterfat production would be 100-135 kg/ha/yr (100 to 120 lb/ac/yr).

Weakly enleached gley-recent soil
(Weakly enleached luvi-madentic soil)

Humic gley soil

SLOPE AND ASPECT Flattish. Low lying area contained by levees of meandering streams.

VEGETATION OF SITE Pasture species: ryegrass (*Lolium spp.*), red clover, (*Trifolium pratense*), suckling clover (*Trifolium dubium*), poa annua.

NATIVE VEGETATION Swamp vegetation

PARENT MATERIAL Fine greywacke alluvium

RAINFALL 650 mm (25 in.)

TEMPERATURE Mean Jan. (summer) 19°C (61°F) Mean July (winter) 5°C (9°F).

ALTITUDE 6 m (20 ft).

LOCATION Williamson's Farm. G.R. S.84 901,419. Ref. Site No. 11.

HORIZON DEPTH	DESCRIPTION	CLAY	SILT	SAND
A 0 - 18 cm (0 - 7 in.)	very dark brown silt loam; firm friable; moderately developed fine granular plus some weakly developed medium nutty structure; prominent reddish brown flecking along root channels; many roots; distinct boundary,	16	63	21
C 18 - 51 cm g (7 - 20 in.)	grey silt loam with faint diffuse reddish yellow mottlings; moderately developed coarse blocky structure breaking to fine blocks,	23	45	32
GC on	grey silt loam with contrasting greenish grey and reddish yellow mottling; completely saturated below 29 in. and resting on dark brown peaty silt loam at 38 in. with weakly decomposed tree remains.	25	62	13

MINERALOGY

Plant Opal	Sericitic	Epidotes	Actinolite	Chlorite	Muscovite	Acid Feldspar	Quartz	Horizon	Sand %
30	1	-	1	1	1	30	40	A	41
1	5	3*	5	3	1	5	37	GC	17
-	-	1	-	15		40	35	Greywacke	

* = largely zoisite

Feldspar	Quartz	Vermiculite-2	Vermiculite-1	Interlayered Micas	Illite	Interlayered Chlorite	Chlorite	Horizon	Clay %
2	3	15	8	4	35	10	6	A	18
6	8	20	-	-	61	-	5	GC	19

- Notes: (1) High plant opal in sand of A horizon from silicified plant remains.
- (2) High actinolite in sand of GC horizon from basic rock contributions.
- (3) High zoisite and sericite in sand of GC horizon due to weathering in gley conditions leading to vermiculite-2 (easily collapsed) in the clay fraction.

CHEMISTRY

Horiz.	Depth	Bulk Dens.	pH	C	N	C/N	CEC	BS	Ca	Mg	K	Na	P Ret ⁿ .
A	0-15cm (0- 6in.)	0.99	5.9	8.0	0.58	14	36.5	91	24.6	5.0	0.26	0.5	32
C _g	20-48cm (8-19in.)	1.48	6.8	0.7	0.05	14	9.1	97	6.6	1.1	0.08	0.3	10
GC	53-69cm (21-27in.)	1.40	6.4	0.7	0.05	14	8.0	85	5.0	1.6	0.09	0.2	10

SPECTROGRAPHIC ANALYSIS (total element levels)

The amounts of the bases Ca, Mg, Na, K in this gleyed recent soil are slightly higher than those in the gley soil (Temuka). The amounts of Al increase down the profile in a similar way to the Temuka soil.

PHYSICAL PROPERTIES

Total porosity is typical of recent soils, medium in the topsoil, low in the subsoil. Macroporosity is low and available moisture capacity high throughout the profile.

BIOLOGY

Yeasts: Candida curvata dominant

AGRICULTURAL NOTES

Taitapu silt loam is a very fertile soil, intensively farmed. Improved drainage may be required for the best results, but the high water table generally associated with this soil is a great advantage in maintaining pasture for summer feed. Dairy farming is most common, usually associated with a limited amount of cash cropping and small seed growing, except in the case of town milk production. A smaller number of farms are intensive mixed cropping units, with fat lamb raising, cash crops and small seeds.

Carrying capacity on a town milk supply farm would be 1 cow/ha (1 cow/2 ac) together with replacement stock. Production would be about 4500 litre/hectare/year (400 gallons). Dry matter production is about 55q/ha/yr (5,000 lb/ac/yr).

Typical yields of cash crops are:

Wheat	35 - 70q/ha	(50 - 100 bu/ac)
Barley	35 - 55q/ha	(60 - 100 bu/ac)
Peas	20 - 55q/ha	(30 - 80 bu/ac)
Potatoes	250 - 450q/ha	(10 - 18 ton/ac)

Typical yields of small seeds:

Ryegrass	700 - 1800 kg/ha	(30 - 80 bu/ac)
White clover	100 - 500 kg/ha	(100 - 450 lb/ac)
Lucerne	100 - 350 kg/ha	(100 - 300 lb/ac)
Red Clover	100 - 500 kg/ha	(100 - 450 lb/ac)

The growing of potatoes is not general because of the risk of wet conditions before digging. Peas are grown for quick-freeze processing. Lucerne grows well.

Pastures respond to Ca and P; spring sown crops to P; potatoes to P and N. No response to K.

Young soil transitional between recent soils and yellow grey earths.

(Moderately upon weakly enleached, subhygrous fulvulvic soil with incipient fragipan)

SLOPE AND ASPECT	Flat. Part of intermediate age fan with site in complex of shallow and deep soils.
VEGETATION OF SITE	Browntop (<u>Agrostis tenuis</u>), sweet vernal (<u>Anthoxanthum odoratum</u>) flatweeds.
NATIVE VEGETATION	Lowland tussock.
PARENT MATERIAL	Fine alluvium from greywacke with very few stones overlying gravels and stones at 1 m (3 ft).
RAINFALL	640 mm (25 in.)
TEMPERATURE	Mean Jan. (summer) 16°C (61°F) Mean July (winter) 5°C (41°F).
ALTITUDE	27 m (90 ft).
LOCATION	Prebbleton cemetery, Paparua Co. 1 ml. W. of Prebbleton, west of junction of Shand and Trent roads. Ref. Site No. 14.

HORIZON	DEPTH	DESCRIPTION	CLAY	SILT	SAND
A ₁	0 - 30 cm (0 - 12 in.)	very dark grey silt loam; very friable; very strongly developed medium and fine nutty and cast granular structure; indistinct boundary,	27	33	40
B ₁	30-43 cm (12-17 in.)	brown silt loam; friable; compact in place, moderately developed medium nutty and cast granular structure,	21	42	37
XB	43-69 cm (17-27 in.)	brown silt loam; many faint reddish brown to dark brown mottles; firm; massive; weakly developed medium nutty structure; indistinct wavy boundary,			
XC	69-91 cm (27-36 in.)	olive grey sandy loam to olive sand; stained dark greyish brown; friable; massive,	11	20	69
	on	stones and gravel with sand matrix.			

MINERALOGY OF SAND AND CLAY *Minerals in sand 0.02 to 2 mm

Depth	Horizon	Sand %	Quartz	Acid Feldspar	Andesine	Glass	Muscovite	Biotite	Chlorite	Hornblende	Pyroxenes	Epidotes	Sericites
0- 8cm (0- 3in)	A ₁₁	57	40	30		1	1		1			1	30
30-41cm (12-16in)	B ₁	55	40	30			1	3	1			1	20
69-81cm (27-32in)	XC	72	40	15					1			1	40

Constituents of clay less than 0.002 mm

Depth	Horizon	Free Fe ₂ O ₃ %	Clay %	Chlorite	Interlayered Chlorite	Illite	Interlayered Mica	Vermiculite-1	Vermiculite-2	Mont- morillonite	Kaolin	Quartz	Feldspar	Hydrated feldspar	Allophane	Halloysite	Gibbsite	Crystoballite
0- 8cm (0- 3in)	A ₁₁	0.8	16	11	16	27	23	3	11			2	8					
30-41cm (12-16in)	B ₁	0.7	16	11	12	31	25	2	14			4	1					
69-81cm (27-32in)	XC	0.5	8	6	21	35	22	6	8			-	2					

Note: (1) Feldspars actively weathering to sericites.

(2) Fairly high levels of chlorite in clays.

* From soil treated H₂O₂ and dithionite; and dispersed 0.02% Na₂CO₃.

CHEMISTRY

Horiz.	Depth	Bulk Dens.	pH	C	N	C/N	CEC	BS	Ca	Mg	K	Na	P Retn.
A ₁	0-8cm (0-3in.)	1.09	5.1	4.4	0.29	15	15.8	42	3.9	2.0	0.67	0.2	30
	8-30cm (3-12in.)		5.4	2.5	0.19	13	12.6	38	2.9	1.5	0.51	0.1	31
B ₁	30-41cm (12-16in.)	1.59	6.0	1.0	0.08	13	8.5	54	2.6	1.8	0.21	0.2	25
XB	48-64cm (19-25in.)	1.70	6.3	0.5	0.04	12	8.9	76	3.9	2.7	0.09	0.2	20
XC	69-81cm (27-32in.)		6.3	0.3	0.03	10	7.6	93	4.5	2.6	0.06	0.2	15

SPECTROGRAPHIC ANALYSIS (total element levels)

Differences in the total element content of horizons are only slight.

PHYSICAL PROPERTIES

Clay content is medium low decreasing sharply to low at about 27 inches. Total porosity decreases down the profile from medium in the topsoil to low below about 8 inches. Macro-porosity is generally medium decreasing with depth. Available moisture capacity is medium in the topsoil, medium low in the subsoil.

AGRICULTURE NOTES

Templeton silt loam is a soil of medium fertility ideally suited for mixed farming i.e. fat lamb raising, cash crops and small seeds production. The soil is free draining but is moisture retentive. Yields of cash crops are within the range - wheat 3000-5500 kg/ha (40-80 bu/ac), barley 3000-4500 kg/ha (50-80 bu/ac), peas 2000-3500 kg/ha (25-50 bu/ac), potatoes 20,000-30,000 kg/ha (8-12 ton/ac). Small seed crop yields range from - white clover (*Trifolium repens*) 110-450 kg/ha (100-400 lb/ac) ryegrass (*Lolium spp.*) 450-1200 kg/ha (20-50 bu/ac). On farms on this soil type, approximately one-third is in cash crops, one-third in small seeds and one-third in pasture or arable crop. Under such a programme 5 ewes/ha (two ewes/ac) are run and lambs fattened.

Pastures respond to Ca and P. Spring-sown crops respond to P. Potatoes respond to P and N. No response to K. No known deficiency troubles in livestock.

Lucerne is a crop which does particularly well on this soil type and supplies most of the hay requirements. It is also grown on this soil for sale as hay or as a green crop for drying for stock food concentrates. Green peas are also grown for the quick freezing trade.

SOUTHERN TOUR

LINCOLN - WELLINGTON (by ship)

SOUTHERN TOUR

WELLINGTON - PALMERSTON NORTH

SOUTHERN TOUR

WILLIAM L. GAYLORD - EDITOR

TOUR NOTES

SOUTHERN TOURWELLINGTON - PALMERSTON NORTH : 133 Miles

Mileage

- 0 Leave Wellington.
- Petone. Site of first European settlement on Wellington Harbour.
- Hutt.
- 14 Taita. Location of Soil Bureau, Department of Scientific and Industrial Research, on the Taita Experimental Station. See separate notes.
- Lunch Stop.
- Silverstream. Pinus plantation on right.
- 20 Upper Hutt. Location of Wallaceville Animal Research Station of Department of Agriculture.
- Macribank. Example of red weathering.
- Terrace on left dislocated by faulting uplifted and moved north.
- Kaitoke Hill. Deep post glacial gravels covered with silts.
- Kaitoke. Location of Animal Research Farm of Department of Agriculture. Experimental work of cobalt, molybdenum and copper in animals.
- Ascend Rimutaka Range, a fairly recent (Pleistocene) uplifted greywacke block.
- Note small areas of red loams developed on intrusions of basic materials (spilites).
- 32 Summit, 1,820 ft (550 m).
- Note variation in depth and degree of podzolisation of Rimutaka steepland soils. Area has been burnt, sown with pasture species and reverted to scrub. Best suited for protective forests.
- Note grove of black beech (Nothofagus solandri) on right at bottom of Range.

Well/P.N.

2.

Sawjaus

Mileage

Approaching Featherston route passes over 15 ft fault trace of the 1855 Wellington earthquake.

38.5 Featherston

Note remnant of native broadleaf forest on left on banks of Tauherenikau River.

Pass across gley soils.

50 Inspect Wharekaka silt loam - see separate notes.

Route passes over stony plains and gley soils.

55 Greytown. Oldest town in Wairarapa, founded in 1854. Site of first cooperative dairy factory in New Zealand, established in 1881.

Note berry fruit orchards on recent soils from alluvium.

Recent soils from alluvium are of high fertility. Production; butterfat 200 lb/ac. per year; $4\frac{1}{2}$ breeding ewes/ac. per year; herbage dry matter 8,000 lb/ac. per year. A typical analysis is:

Depth	<u>pH</u>	<u>C</u>	<u>N</u>	<u>C/N</u>	<u>CEC</u>	<u>BS</u>
0-6 in (0-10 cm)	5.5	4.0	0.35	11	19.4	54
8-14 in (18-36 cm)	5.9	4.4	0.15	9	12.8	63

Cross Waiohine River.

59.5 Carterton.

Inspect Kopua gravelly loam - see separate notes.

Waingawa River.

72.5 Masterton. Centre of Wairarapa Valley, a large agricultural district and headquarters of Catchment Board. 350 ft above sea level, rainfall 38 in.

Note Tararua Range on left.

Travel across stony yellow-brown loams on old river terraces.

Cross Ruamahunga River.

Mileage

- 91.5 Mt Bruce Saddle, 1,183 ft. (360 m).
Travel over yellow-brown earths on hilly land.
Cross Makakahi River.
Eketahuna. 3:23 PM
Pahiatua.
Pass over yellow-brown loams on terrace land developed under
50 in. rainfall.
Cross Manawatu and Mangatainoka Rivers.
- 124 Woodville.
Travel through Manawatu Gorge.
Note remnants of Beech forest on left.
- 133 Palmerston North.

At the mouth of the river, the water is very shallow and the bottom is composed of soft mud.

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Strongly leached, strongly weathered central yellow-brown earth from strongly weathered greywacke.
(Strongly enleached, clay illuvial surfuvic soil from strongly argillised greywacke)

Red-yellow podsolic soil.

SLOPE AND ASPECT 16°N.

VEGETATION OF SITE Manuka (*Lepto spermum*), spanish heath (*Erica lusitanica*), gorse (*Ulex europaeus*), pinus radiata, $\frac{1}{4}$ - $\frac{1}{2}$ in. dry litter from manuka, heath and gorse.

NATIVE VEGETATION *Nothogagus truncata*.

PARENT MATERIAL Deeply weathered greywacke.

RAINFALL 1300 mm (50 in.)

TEMPERATURE Mean Jan. (summer) 16°C (61°F) Mean July (winter) 7°C (45°F).

ALTITUDE 115 m (370 ft).

LOCATION Taita Experimental Station. G.R. 508347 on N.160.
Ref. Site No. 4.

HORIZON DEPTH	DESCRIPTION	CLAY	SILT	SAND	STONES
A ₁ 0 - 8 cm (0 - 3 in.)	very dark greyish brown clay loam; firm; weakly developed medium nutty structure with some coarse cast granular; many roots; sharp irregular boundary,	39	34	26	1
B ₂ 8 - 46 cm (3 - 18 in.)	yellowish brown to brownish yellow clay; very firm; moderately developed coarse nutty structure with pale yellowish brown coating to peds; dark greyish brown clay loam in cracks; few fine reddish yellow mottles; many to few roots; indistinct boundary,	65	21	14	
C on	brownish yellow and red stony clay with weakly developed blocky structure. The stones are pieces of weathered greywacke.				

MINERALOGY OF SAND AND CLAY*Minerals in sand 0.02 to 2 mm

Depth	Horizon	Sand %	Quartz	Acid Feldspar	Andesine	Glass	Muscovite	Biotite	Chlorite	Hornblende	Pyroxenes	Epidotes	Chert
0- 5cm (0- 2in.)	A ₁	46	-	-		-					-	-	-
8-23cm (3- 9in.)	B ₂	30	> 50	30		15	1			1	1	6	15
25-38cm (10-15in.)		21	> 50	30		3	1		1				
53-71cm (21-28in.)	C	18	> 50	1		1	1		15	1		1	50
Greywacke			35	40				15		1		1	

Constituents of clay less than 0.002 mm

Depth	Horizon	Free Fe ₂ O ₃ %	Clay %	Chlorite	Interlayered Chlorite	Illite	Interlayered Mica	Vermiculite-1	Vermiculite-2	Mont- morillonite	Kaolin	Quartz	Feldspar	Hydrous- feldspar	Allophane	Halloysite	Gibbsite	Cristobalite
0- 5cm (0- 2in.)	A ₁	1.1	25			-	37	4	-		59							
25-38cm (10-15in.)	B ₂	5.5	53			3	32		7		58							
53-71cm (21-28in.)	C	7.1	49			7	30	3	10		50							

- Notes: (a) % sand is lowest in C horizon which has low feldspar content due to pre-weathering of greywacks.
 (b) Higher feldspar in sand of A & B horizons may be due to contributions from fresher greywacke.
 (c) Glass is probably from rhyolitic ash which may have increased feldspar in upper horizons.
 (d) Kaolin is derived from parent weathered greywacks.
 (e) Free Fe₂O₃ includes haematite which increases in subsoil due to illuviation.

* From soil treated H₂O₂ and dithionite; and dispersed 0.02% Na₂CO₃.

CHEMISTRY

Horis.	Depth	Bulk Dens.	pH	C	N	C/N	CEC	BS	Ca	Mg	K	Na	P Retn.
A ₁	0-8cm (0-3in.)	0.93	4.7	4.9	0.18	27	18.7	39	3.9	2.9	0.41	0.3	35
B ₂	8-23cm (3-9in.)	1.19	4.9	1.6	0.08	20	18.2	28	2.2	2.3	0.34	0.2	46
	25-38cm (10-15in.)	1.18	4.9	1.3	0.08	16	18.1	17	1.3	1.4	0.27	0.2	61
C	46-51cm (18-20in.)	1.19	4.9	0.8	0.06	13	14.9	9	0.6	0.9	0.17	0.1	64
	53-71cm (21-28in.)	1.30	5.0	0.6	0.05	12	16.0	8	0.3	0.9	0.21	0.1	60

COMMENTS

The rather weathered nature of the parent material is reflected in a very low total-P content (<0.02%), low total S (<0.03%) and a moderate build-up of adsorbed sulphate in the subsoil which is unusual in this weathering zone. These properties are associated with a high proportion (ca. 50%) of kaolin in the clay throughout the profile. Low pH and very low base saturation in the subsoil indicate strong leaching also.

SPECTROGRAPHIC ANALYSIS (total element levels)

The 1 cm ($\frac{1}{2}$ inch) litter horizon has a very high amount of Mn and only a moderate to low amount of the other metallic elements.

The lower horizons are strongly weathered and high in K, Ba, Al, Ti, Ga, V, Fe and low in Ca, Na, Sr.

PHYSICAL PROPERTIES

Clay figures increase sharply from medium in the topsoil to high in the subsoil. Total porosity and macro-porosity are approximately constant in the lower parts of the horizon being respectively medium and low. In the topsoil they increase to high for both measurements. Available moisture capacity ranges from medium in the topsoil to low in the subsoil.

BIOLOGY

Algae: Blue green algae absent under scrub, but present under pasture. Diatoms relatively rich under pasture.

Yeasts: Under scrub Cryptococcus albidus is dominant whereas under pasture or pines Candida curvata is dominant.

Animals: Earthworms: Wide, open and infilled burrows formed by Octochaetus multiporus prominent at 4-30in.

Other animals: Rich litter fauna, high proportion of mites.

C/N ratio wide indicating a relatively slow rate of decomposition.

AGRICULTURAL NOTES

Taita clay loam is an extremely difficult soil type from a farming point of view. The natural fertility of the top soil is low as it is very deficient in phosphate, molybdenum and lime and moderately deficient in potash. This low fertility, combined with steep slopes and stiff texture make establishment of pasture species by oversowing extremely difficult. While good pastures may be readily established following cultivation and the application of fertilisers, the discable area is so small that this method is of little practical significance.

The Taita Experimental Station of about 200 acres, where the Soil Bureau is located, was established on this soil type to provide not only a good site for laboratories and offices in the Wellington district, but to provide a stimulating background of soils and vegetation. The location is, geographically fairly central in New Zealand, and the soils are representative of the strongly and moderately leached yellow-brown earths, of which there are some nine million acres in the country. The soils are near enough to a division in the classification of the yellow-brown earths for some of them to show features of the yellow-grey earths. Areas are to be maintained under native forest and scrub, exotic timber trees, and grass-clover pastures.

The main reasons for the present cover of manuka and gorse on this soil are economic rather than pedological. Due to proximity to Hutt and Wellington cities the land is held in unfarmable blocks of about 300 acres. The only way in which Taita clay loam could maintain productive and weed-free pastures would be to use it in conjunction with the adjacent higher fertility soils of the valley floors. However the latter are used either for housing, or industry or are being grazed by city milk supply dairy herds which are of little use for weed control. Thus the Taita soils have reverted to dense heath, manuka and gorse, the latter becoming dominant following successive accidental fires.

Very good Pinus radiata plantations, established 20-30 years ago, exist in Pinehaven in the Hutt Valley. With increasing population the fire danger is now very great for tree planting on this soil type.

The most economic use for this soil near Hutt and Wellington is suburban housing and large scale development for this purpose is now taking place.

1. The first part of the paper discusses the importance of the study and the objectives of the research. It also mentions the scope of the study and the limitations of the study.

2. The second part of the paper discusses the methodology used in the study. It includes a description of the sample, the data collection methods, and the data analysis methods. It also mentions the ethical considerations of the study.

3. The third part of the paper discusses the results of the study. It includes a description of the findings and the conclusions drawn from the study. It also mentions the implications of the study for future research.

4. The fourth part of the paper discusses the limitations of the study and the suggestions for future research. It also mentions the contributions of the study to the field of research.

SOILS OF SOUTHERN WAIRARAPA DISTRICT

Notes by H. S. Gibbs

The soils are conveniently described in three physiographic regions - western ranges, central plains and eastern hills. The boundaries between these regions coincide generally with two major faults - Rimutaka fault along the base of the western ranges and the parallel Wairarapa fault, 12 miles to the eastward. Both faults are old but have shown movements within historic times. Scarplets indicate both uplift and transcurrent components to movements.

On the western ranges the soils are mainly steep-land yellow-brown earths with weak podzolisation and slight to moderate gleying above 1800 ft. Small areas of strongly leached, moderately weathered yellow-brown earths occur on rolling and terrace lands within valleys of the region. All these soils are derived from greywacke or erosion products of greywacke. Annual rainfalls increase from 60 in. on the border with the plains, to 200 in. on the mountain tops. Vegetation is tussock grassland above 4,000 ft, silver beech forest below that level and grading down through red beech to hard beech in the southern end and to podocarp forest in the northern end. Owing to low fertility and liability to scree and sheet erosion, pastoral farming has not been successful. Some timber may be obtained from lower slopes near the plains but elsewhere the soils are best kept for permanent protective forestry. Considerable erosion in the tussock grassland and upper forest edge has occurred and is attributed to accidental fires and to concentrated grazing by deer.

On the central plains the broad soil pattern from west to east is:

- yellow-brown earths on dissected remnants of an elevated alluvial plain (probably Early Pleistocene). Matamau soils
- yellow-brown loams on freedraining stony fans built by rivers flowing out of the western ranges since the last glaciation. Kopua soils
- gley soils on toes of the stony fans and interfan depressions where watertables are high.
- recent soils on floodplains bordering the rivers and flat land around Lake Wairarapa where accumulation is occurring
- yellow-grey earths on terrace and undulating land on the eastern side of the plain and representing remnants of a cycle of erosion prior to the fan building period. They also occur on low ridges rising out of middle portions of the plains. Wharekaka soils

All these soils are derived mainly from products of erosion of the greywacke ranges with a small contribution to recent soils of silt and clay from erosion of Tertiary beds to the east. On the yellow-brown loams, parent materials are 6-24 in. of silts over gravels, whereas on yellow-grey earths the silts are usually 3 to 6 feet thick.

The native vegetation probably was podocarp or beech forest near the western ranges; totara forest, fern and grassland on the drier stony plains; podocarp and broadleaved forest on gley soils and recent soils, patches podocarp forest, fern and grassland on the yellow-grey earths. The fern may have been a result of fires in pre-European times.

Annual rainfalls decrease across the plains from 60 to 35 in. with a zone of 35-30 in. around Martinborough. The distribution of this rainfall becomes more and more uneven as the total decreases. The yellow-brown earths and loams occur in the 60-40 in. zone and the yellow-grey earths in the 45-30 in. zone. In the 40-45 in. zone the boundary between yellow-brown loams and yellow-grey earths is generally abrupt and marked by a low scarp from river fan to terrace of an older cycle and increase in depth of silts. The boundary between yellow-brown loams and yellow-brown earths is also marked by an increase in altitude and depth of silts. In this case there is no apparent trend in climatic conditions and raises the question of classification - Are the yellow-brown loams from alluvial materials really an immature stage of yellow-brown earths and limited in development by time. The friable consistence and fine structure are attributed to free oxides of iron and aluminium released by weathering.

In the 30-35 in. zone the yellow-grey earths are weakly to moderately gleyed and have a distinct dense fragipan beginning about 20 in. from the surface. In the 35-45 in. zone the yellow-grey earths are strongly gleyed and the fragipan is less distinct and begins 26-36 in. below the surface. Total rainfalls are probably not strictly comparable with other districts because the Wairarapa is subject to frequent strong winds which have a severe drying effect on the soils. The boundary between yellow-grey earths and recent soils is very indistinct being indicated by a gradual increase in compaction in the 10-18 in. depth and the development of reticulate grey mottling below 18 in. and above the gravelly substratum.

The gradation from yellow-grey earth to yellow-brown earth is marked by the following trends in the profiles.

- (1) A horizon change in colour from greyish brown to brown
B horizon change in colour with decrease in mottling.
- (2) Increase in clay content of A horizon and/or decrease in difference in clay content between A and B horizons.
- (3) Change in consistence of B horizon from firm to friable and disappearance of fragipan.
- (4) Decrease in size of aggregates of B horizon from medium to fine and increase in degree of development.

(5) Decreasing % base saturation and exchangeable cations in B and C horizons.

A stage of development beyond yellow-brown earth is found in the Haurangi ranges at altitudes above 1,200 ft. Here, high rainfall (60-100 in.) and podocarp-beech forest combine to produce podzolised yellow-brown earths from greywacke. These soils have a mor horizon 4-6 in. thick, a pale grey A₂ horizon 1-2 in. thick and a discontinuous thin iron pan over yellowish brown stony silt loam. Such soils are of very low fertility, erode easily under grazing and are best retained in protective forest.

Thus in the southern Wairarapa there is a wide range of soils that can be explained by regional differences of climate and vegetation and by local differences of topography, rock materials and age of the land.

CHEMISTRY

Horiz.	Depth	pH	C	N	CEC	B.S.	Ca	Mg	K	Na
A	0-7	5.9	4.0	0.3	15.3	53	3.8	3.8	0.8	n.d.
B _{2g}	9-14	5.9			9.3	33	1.4	1.7	0.4	"
B _{3g}	16-22	6.3			13.1	57	3.8	3.8	0.3	"
C _m	22-28	6.5			13.0	70	4.1	5.0	0.2	"
	yellow C				11.3	26				0.5
	white vein				11.4	27				0.5

Depth	Bulk Dens.	Porosity %
0-3	0.84	65
5-9	1.35	49
10-13	1.46	45
16-19	1.53	43
21-26	1.77	33
30-33	1.94	28

Clay mineral analyses show little vermiculite in topsoil but increasing downward.

KOPUA STONY SILT LOAM

Moderately to strongly leached, scrub melanised yellow-brown loam from alluvium.
(Moderately to strongly enleached fulvi-alvic soil.)

22.0	3.5	2.01	94	5.21	5.85	64.0	1.1	4.2	2.0
20.0	5.0	2.1	21	5.2	4.71			6.2	21-9

SLOPE AND ASPECT Flat terrace.

VEGETATION OF SITE Pasture.

NATIVE VEGETATION Secondary manuka scrub and primary totara "parkland".

PARENT MATERIAL Unconsolidated silts and gravels derived from greywacke.

RAINFALL 1,000-1,125 mm (40-45 in.).

TEMPERATURE 54°F (mean)

ALTITUDE 125 m (400 ft).

LOCATION Gravel pit, Waigawa. G.R. 092606 on N.158.

HORIZON DEPTH

DESCRIPTION

- A 15 cm
(6 in.) very dark brown stony silt loam; very friable; moderately developed fine granular structure in top 2 in. and grading down into weakly developed fine nutty structure; few casts; abundant roots with fine crumbs attached; irregular indistinct boundary,
- B 23 cm
(9 in.) yellowish brown stony silt loam; friable; weakly developed fine nutty to blocky structure; many roots especially around stones; irregular distinct boundary,
- on stones, gravels and boulders with a dark reddish brown clay? coating to particles to a depth of 12-18 in.; moderately compacted in upper 12-18 in. and slightly compacted below.

Profile Notes: Depth of fine soil over the stony substratum varies from 9-24 in. and where deeper than 15 in. the horizon consists of yellowish brown gravelly silt loam.

CHEMISTRY

Depth	pH	C	N	CEC	T.C.	Satn	Ca	Mg	K
0-6	5.5	7.1	0.43	28.2	13.2	47	10.3	2.6	0.55
9-15	5.6			17.4	2.2	13	1.5	0.7	0.30

Strongly leached, moderately weathered yellow-brown earth. Hq
 (Strongly enleached fulvic soil.) Hq

SLOPE AND ASPECT 15° slope on hilly land.

VEGETATION OF SITE Roadside pasture and bracken fern.

NATIVE VEGETATION Podocarp-broadleaf forest.

PARENT MATERIAL Weakly consolidated siltstone of Early Pleistocene.

RAINFALL 1,500 mm (60 in.)

TEMPERATURE 52°F (mean)

ALTITUDE 350 m (1,200 ft).

LOCATION Mt Bruce Saddle

HORIZON DEPTH

DESCRIPTION

- A (0-8 in.) dark brown silty clay loam; friable; moderately developed medium nutty structure with fine granular structure in top ½ in.,
- B (9-18 in.) yellowish brown silty clay loam; friable; moderately developed medium nutty structure,
- C (18-28 in.) pale yellowish brown silty clay loam; firm; weakly developed medium blocky structure,
- on grey siltstone with strong brown mottles.

CHEMISTRY (from another site)

Depth	pH	C	N	CEC	T.C.	Satn	Ca	Mg	K
0-7	5.3	6.6	0.42	23.2	5.0	22	3.0	1.3	0.85
10-18	5.6	1.7	0.14	14.3	2.2	15	1.3	0.6	0.50
20-30	5.1	0.6	0.07	15.2	1.2	8	0.8	0.4	0.30

MECHANICAL ANALYSIS

Depth	C.Sand	F.Sand	Silt	Clay	Texture
0-7	0.3	24.0	26.0	26.8	clay loam
10-18	0.4	31.3	28.0	29.3	clay loam
20-30	1.0	36.8	24.7	25.8	clay loam

Road

Main

Appendix II

New Zealand

*1956
Appendix II*

Road Maps

New Zealand

WITH INDEX AND
MILEAGE CHARTS

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NORTH ISLAND TRAVEL TIME MAP

Use this map to plan your driving—avoid fatigue and accidents.

Based on: Actual driving times for a driver who travels at 45 to 50 m.p.h. on open stretches of road. **Plus** a safety factor of 5 to 10 minutes per hour for short refreshment stops or minor traffic delays.

Slower Drivers: The times also approximate the driving time (with no safety factor) for a driver who travels at about 40 m.p.h. on open stretches of road. Allow an extra 10 minutes per hour for safety.

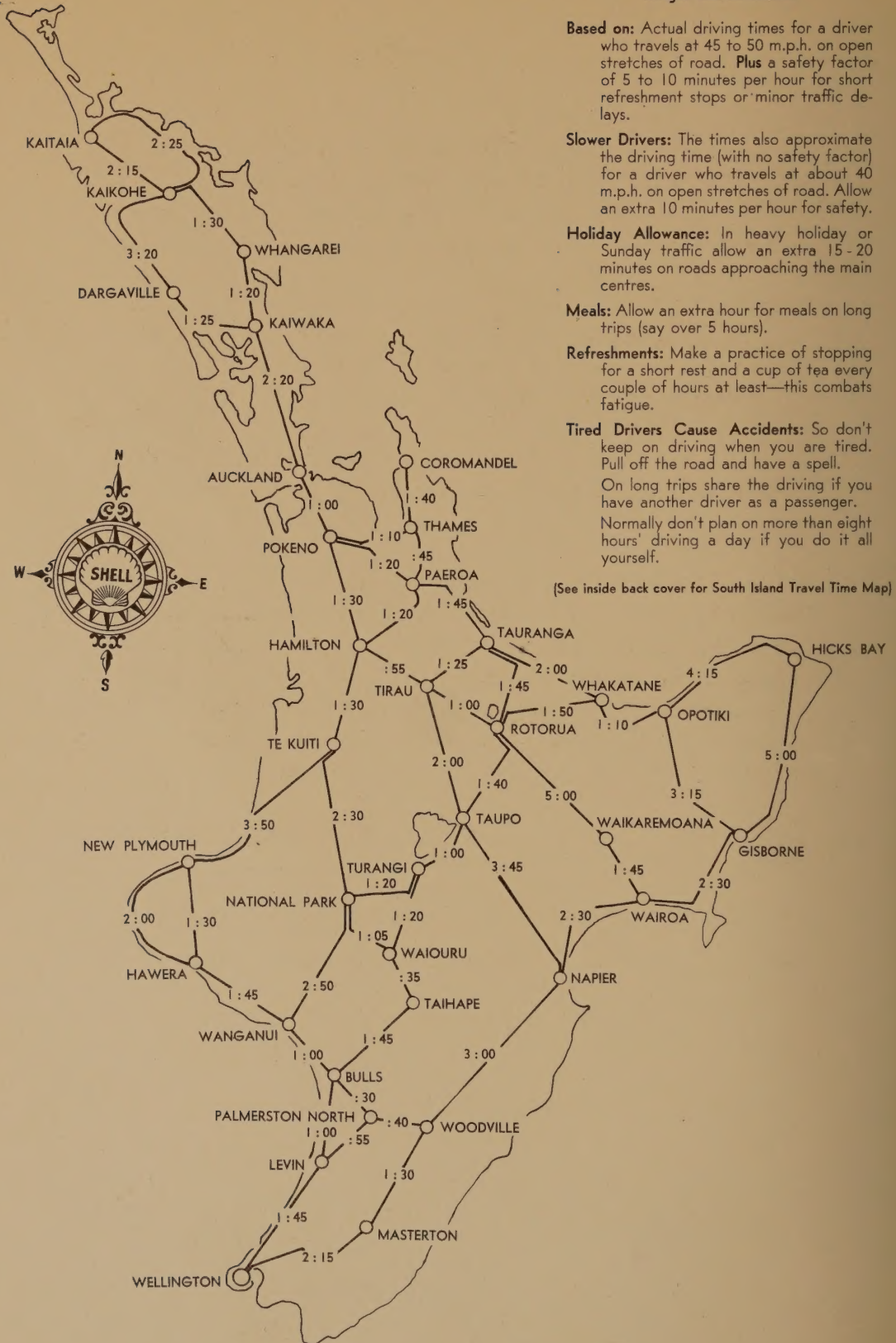
Holiday Allowance: In heavy holiday or Sunday traffic allow an extra 15-20 minutes on roads approaching the main centres.

Meals: Allow an extra hour for meals on long trips (say over 5 hours).

Refreshments: Make a practice of stopping for a short rest and a cup of tea every couple of hours at least—this combats fatigue.

Tired Drivers Cause Accidents: So don't keep on driving when you are tired. Pull off the road and have a spell. On long trips share the driving if you have another driver as a passenger. Normally don't plan on more than eight hours' driving a day if you do it all yourself.

(See inside back cover for South Island Travel Time Map)



Kellogg

WE TAKE GREAT PLEASURE in presenting to you this book of New Zealand road maps as part of our Shell service to motorists. We trust that it will accompany you over many miles of safe and enjoyable motoring.

Even though no one set of road maps will serve every possible purpose, in compiling the information contained in this book every care has been taken to ensure that the details you require are presented legibly, compactly and accurately. Charts which show at a glance the mileages between main towns in either island; outlet maps of the four main cities and lists of tourist attractions have been included to extend the usefulness of this book.

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Coulls Somerville Wilkie Ltd. (Printers)



NORTH ISLAND MILEAGE CHART ■ SHORTEST MAIN ROUTES ■ To nearest mile



	AUCKLAND	BULLS	DANNEVIRKE	DARGAVILLE	FEATHERSTON	FOXTON	GISBORNE	HAMILTON	HASTINGS	HAWERA	HICKS BAY	KAEO	KAIKOHE	KAITAIA	KAIWAKA	LEVIN	MASTERTON	NAPIER	NEW PLYMOUTH	PAEKAKARIKI	PAHIA	PAHIA TUA	POKERO	RAETIHI	ROTORUA	TAHAPAE	TAURANGA	TAUMARUNUI	TE AWAMUTU	TE KUITI	TIRAU	WAIKURAU	WAIKURU	WAIROA	WAITARA	WANGANUI	WARKWORTH	WELLINGTON	WHAKATANE	WHANGAREI	WOODVILLE			
AUCKLAND	●	327	358	114	433	351	333	83	289	276	335	185	164	214	66	363	413	277	218	241	240	398	346	372	35	240	152	277	137	188	182	102	133	118	257	324	340	231	299	41	425	199	108	364
BULLS	327	●	55	441	105	24	277	244	124	85	392	512	491	541	393	36	85	136	109	130	87	71	19	45	292	86	205	55	262	139	150	225	194	214	75	89	215	130	28	368	98	287	435	37
DANNEVIRKE	358	55	●	472	90	60	222	275	69	140	337	543	522	578	424	67	66	81	164	185	148	103	36	26	323	142	231	110	288	194	176	280	249	240	130	34	160	185	83	399	129	284	466	18
DARGAVILLE	114	441	472	●	546	465	447	197	403	390	449	91	87	102	48	477	526	391	332	355	354	512	460	486	149	354	266	391	251	302	296	216	247	232	371	438	454	345	413	73	539	313	39	478
FEATHERSTON	433	105	90	546	●	81	312	349	159	190	427	617	596	646	498	69	23	171	214	235	198	52	90	64	397	192	314	164	371	248	259	330	299	323	184	124	250	235	133	473	42	374	540	72
FOXTON	351	24	60	465	81	●	301	268	148	109	416	536	515	565	417	12	104	160	133	154	117	47	24	69	316	119	229	79	286	163	174	249	218	238	99	101	227	154	52	392	74	282	459	42
GISBORNE	333	277	222	447	312	301	●	256	153	362	115	518	497	547	399	289	288	141	290	407	312	324	258	248	298	312	187	315	196	292	220	275	306	221	295	188	66	407	305	374	351	134	441	240
HAMILTON	83	244	275	197	349	268	256	●	206	193	258	268	247	297	149	280	329	194	135	158	157	314	263	289	48	157	69	194	68	105	99	19	50	35	174	241	257	148	216	124	342	130	191	286
HASTINGS	289	124	69	403	159	148	153	206	●	209	268	487	453	503	355	136	135	12	177	254	199	171	105	95	254	199	162	179	219	179	107	225	234	171	182	35	91	254	152	330	198	215	397	87
HAWERA	276	85	140	390	190	109	362	193	209	●	446	461	440	490	342	121	170	221	138	45	122	156	104	130	241	116	263	140	261	168	208	174	143	228	160	174	300	45	57	317	183	316	384	122
HICKS BAY	335	392	337	449	427	416	115	258	268	446	●	520	499	549	401	404	403	256	314	424	336	439	373	363	300	336	189	339	198	316	244	277	308	223	319	303	177	406	395	376	466	136	443	355
KAEO	185	512	543	91	617	536	518	268	487	461	520	●	39	49	119	554	603	462	403	426	425	583	531	557	220	425	337	462	322	373	367	287	318	303	442	509	525	416	484	144	610	384	77	561
KAIKOHE	164	491	522	87	596	515	497	247	453	440	499	39	●	50	98	527	576	441	382	405	404	562	510	548	199	404	316	441	301	352	346	266	297	282	421	488	504	395	463	123	589	363	56	528
KAITAIA	214	541	578	102	646	565	547	297	503	490	549	49	50	●	139	577	626	491	432	455	454	612	560	586	249	454	366	491	351	402	396	316	347	332	471	538	554	445	513	173	639	413	106	578
KAIWAKA	66	393	424	48	498	417	399	149	355	342	401	119	98	139	●	429	479	343	284	307	306	464	412	443	101	306	218	343	203	254	248	168	199	184	323	390	406	297	365	25	491	265	42	430
LEVIN	363	36	67	477	69	12	289	280	136	121	404	554	527	577	429	●	87	148	145	166	129	35	31	57	328	123	241	91	298	175	186	261	230	250	111	101	227	166	64	404	62	294	471	49
MASTERTON	413	85	66	526	23	104	288	329	135	170	403	603	576	626	479	87	●	147	194	215	178	78	66	41	377	172	290	140	347	224	235	310	279	299	160	100	226	215	113	453	66	343	520	48
NAPIER	277	136	81	391	171	160	141	194	12	221	256	462	441	491	343	148	147	●	165	266	187	183	117	107	242	187	150	191	207	167	95	213	222	159	170	47	79	266	164	318	210	203	385	99
NATIONAL PARK	218	109	164	332	214	133	290	135	177	138	314	403	382	432	284	145	194	165	●	183	22	180	128	154	183	22	125	83	182	30	70	116	85	134	39	198	228	183	81	259	207	178	326	146
NEW PLYMOUTH	241	130	185	355	235	154	407	158	254	45	424	426	405	455	307	166	215	266	183	●	167	201	149	175	206	161	227	185	226	163	235	139	108	193	201	219	345	10	102	282	228	280	349	167
OHAKUNE	240	87	148	354	198	117	312	157	199	122	336	425	404	454	306	129	178	187	22	167	●	164	106	132	205	6	147	40	195	52	92	138	107	156	17	182	250	167	65	281	191	200	348	124
PAEKAKARIKI	398	71	103	512	52	47	324	314	171	156	439	583	562	612	464	35	78	183	180	201	164	●	66	92	363	158	276	126	324	210	221	296	265	285	146	136	262	201	99	439	27	329	506	84
PALMERSTON NORTH	346	19	36	460	90	24	258	263	105	104	373	531	510	560	412	31	66	117	128	149	106	66	●	26	311	106	224	74	272	158	169	244	213	233	94	70	196	149	47	387	93	277	454	18
PAHIA TUA	372	45	26	486	64	69	248	289	95	130	363	557	548	586	443	57	41	107	154	175	132	92	26	●	337	132	250	100	298	184	195	270	239	259	120	60	186	175	73	413	106	303	480	8
POKERO	35	292	323	149	397	316	298	48	254	241	300	220	199	249	101	328	377	242	183	205	205	363	311	337	●	205	117	242	102	153	147	67	98	83	222	289	305	196	264	76	390	164	443	329
RAETIHI	240	86	142	354	192	119	312	157	199	116	336	425	404	454	306	123	172	187	22	161	6	158	106	132	205	●	147	37	204	52	92	138	107	156	17	176	250	161	59	281	185	200	348	124
ROTORUA	152	205	231	266	314	229	187	69	162	263	189	337	316	366	218	241	290	150	125	227	147	276	224	250	117	147	●	150	57	127	55	88	119	34	130	197	213	217	206	193	303	53	260	242
TAHAPAE	277	55	110	391	164	79	315	194	179	140	339	462	441	491	343	91	140	191	83	185	40	126	74	100	242	37	150	●	207	92	95	178	147	159	20	144	253	185	83	318	153	203	385	92
TAURANGA	137	262	288	251	371	286	196	68	219	261	198	322	301	351	203	298	347	207	182	226	195	324	272	298	102	204	57	207	●	173	112	87	118	39	187	254	258	216	254	178	338	62	245	290
TAUMARUNUI	188	139	194	302	248	163	292	105	179	168	316	373	352	402	254	175	224	167	30	163	52	210	158	184	153	52	127	92	173	●	72	86	53	136	72	214	230	153	111	229	237	180	296	176
TAUPO	182	150	176	296	259	174	220	99	107	208	244	367	346	396	248	186	235	95	70	235	92	221	169	195	147	92	55	95	112	72	●	118	127	64	75	142	158	225	151	223	248	108	290	194
TE AWAMUTU	102	225	280	216	330	249	275	19	225	174	277	287	266	316	168	261	310	213	116	139	138	296	244	270	67	138	88	178	87	86	118	●	31	54	158	260	276	129	197	143	323	141	210	262
TE KUITI	133	194	249	247	299	218	306	50	234	143	308	318	297	347	199	230	279	222	85	108	107	265	213	239	98	107	119	147	118	53	127	31	●	85	127	269	285	98	166	174	292	172	241	231
TIRAU	118	214	240	232	323	238	221	35	171	228	223	303	282	332																														



NORTH ISLAND MILEAGE CHART - SHORTEST MAIN ROUTES - To nearest mile



	AUCKLAND	BULLS	DANNEVIRKE	DARGAVILLE	FEATHERSTON	FOXTON	GISBORNE	HAMILTON	HASTINGS	HAWERA	HICKS BAY	KAEO	KAIKOHE	KAITIA	KAIWAKA	LEVIN	MASTERTON	NAPIER	NEW PLYMOUTH	OHAKUNE	PAEKAKARIKI	PAHIATUA	POKENO	RAETIHI	ROTORUA	TAIHAPE	TAURANGA	TAUMARUNUI	TE AWAMUTU	TE KUITI	TIRAU	WAIKURAU	WAIROA	WAITARA	WANGANUI	WARKWORTH	WELLINGTON	WHAKATANE	WHANGAREI	WOODVILLE					
AUCKLAND	●	327	358	114	433	351	333	83	289	276	335	185	164	214	66	363	413	277	218	241	240	398	346	372	35	240	152	277	137	188	182	102	133	118	257	324	340	231	299	41	425	199	108	364	
BULLS	327	●	55	441	105	24	277	244	124	85	392	512	491	541	393	36	85	136	109	130	87	71	19	45	292	86	205	55	262	139	150	225	194	214	75	89	215	130	28	368	98	287	435	37	
DANNEVIRKE	358	55	●	472	90	60	222	275	69	140	337	543	522	578	424	67	66	81	164	185	148	103	36	26	323	142	231	110	288	194	176	280	249	240	130	34	160	185	83	399	129	284	466	18	
DARGAVILLE	114	441	472	●	546	465	447	197	403	390	449	513	522	578	424	67	66	81	164	185	148	103	36	26	323	142	231	110	288	194	176	280	249	240	130	34	160	185	83	399	129	284	466	18	
FEATHERSTON	433	105	90	546	●	81	312	349	159	190	427	617	596	646	498	69	23	171	214	235	198	52	90	64	397	192	314	164	371	248	259	330	299	323	184	124	250	235	133	473	42	374	540	72	
FOXTON	351	24	60	465	81	●	301	268	148	109	416	536	515	565	417	12	104	160	133	154	117	47	24	69	316	119	229	79	286	163	174	249	218	238	99	101	227	154	52	392	74	282	459	42	
GISBORNE	333	277	222	447	312	301	●	256	153	362	115	518	497	547	399	289	288	141	290	407	312	324	258	248	298	312	187	315	196	292	220	275	306	221	295	188	66	407	305	374	351	134	441	240	
HAMILTON	83	244	275	197	349	268	256	●	206	193	258	268	247	297	149	280	329	194	135	158	157	314	263	289	48	157	69	194	68	105	99	19	50	35	174	241	257	148	124	342	130	191	286		
HASTINGS	289	124	69	403	159	148	153	206	●	209	268	487	453	503	355	136	135	12	177	254	199	171	105	95	254	199	162	179	219	179	107	225	234	171	182	35	91	254	152	330	198	215	397	87	
HAWERA	276	85	140	390	190	109	362	193	209	●	446	461	440	490	342	121	170	221	138	45	122	156	104	130	241	116	263	140	261	168	208	174	143	228	160	174	300	45	57	317	183	316	384	122	
HICKS BAY	335	392	337	449	427	416	115	258	268	446	●	520	499	549	401	404	403	256	314	424	336	439	373	363	300	336	189	339	198	316	244	277	308	223	319	303	177	406	395	376	466	136	443	355	
KAEO	185	512	543	91	617	536	518	268	487	461	520	●	39	49	119	554	603	462	403	426	425	583	531	557	220	425	337	462	322	373	367	287	318	303	442	509	525	416	484	144	610	384	77	561	
KAIKOHE	164	491	522	87	596	515	497	247	453	440	499	39	●	50	98	527	576	441	382	405	404	562	510	548	199	404	316	441	301	352	346	266	297	282	421	488	504	395	463	123	589	363	56	528	
KAITIA	214	541	578	102	646	565	547	297	503	490	549	49	50	●	139	577	626	491	432	455	454	612	560	586	249	454	366	491	351	402	396	316	347	332	471	538	554	445	513	173	639	413	106	578	
KAIWAKA	66	393	424	48	498	417	399	149	355	342	401	119	98	139	●	429	479	343	284	307	306	464	412	443	101	306	218	343	203	254	248	168	199	184	323	390	406	297	365	25	491	265	42	430	
LEVIN	363	36	67	477	69	12	289	280	136	121	404	554	527	577	429	●	87	148	145	166	129	35	31	57	328	123	241	91	298	175	186	261	230	250	111	101	227	166	64	404	62	294	471	49	
MASTERTON	413	85	66	526	23	104	288	329	135	170	403	603	576	626	479	87	●	147	194	215	178	78	66	41	377	172	290	140	347	224	235	310	279	299	160	100	226	215	113	453	66	343	520	48	
NAPIER	277	136	81	391	171	160	141	194	12	221	256	462	441	491	343	148	147	●	165	266	187	183	117	107	242	187	150	191	207	167	95	213	222	159	170	47	79	266	164	318	210	203	385	99	
NATIONAL PARK	218	109	164	332	214	133	290	135	177	138	314	403	382	432	284	145	194	165	●	183	22	180	128	154	183	22	125	83	182	30	70	116	85	134	39	198	228	183	81	259	207	178	326	146	
NEW PLYMOUTH	241	130	185	355	235	154	407	158	254	45	424	426	405	455	307	166	215	266	183	●	167	201	149	175	206	161	227	185	226	163	235	139	108	193	201	219	345	10	102	282	228	280	349	167	
OHAKUNE	240	87	148	354	198	117	312	157	199	122	336	425	404	454	306	129	178	187	22	167	●	164	106	132	205	6	147	40	195	52	92	138	107	156	17	182	250	167	65	281	191	200	348	124	
PAEKAKARIKI	398	71	103	512	52	47	324	314	171	156	439	583	562	612	464	35	78	183	180	201	164	●	66	92	363	158	276	126	324	210	221	296	265	285	146	136	262	201	99	439	27	329	506	84	
PALMERSTON NORTH	346	19	36	460	90	24	258	263	105	104	373	531	510	560	412	31	66	117	128	149	106	66	●	26	311	106	224	74	272	158	169	244	213	233	94	70	196	149	47	387	93	277	454	18	
PAHIATUA	372	45	26	486	64	69	248	289	95	130	363	557	548	586	443	57	41	107	154	175	132	92	26	●	337	132	250	100	298	184	195	270	239	259	120	60	186	175	73	413	106	303	480	8	
POKENO	35	292	323	149	397	316	298	48	254	241	300	220	199	249	101	328	377	242	183	206	205	363	311	337	●	205	117	242	102	153	147	67	98	83	222	289	305	196	264	76	390	164	143	329	
RAETIHI	240	86	142	354	192	119	312	157	199	116	336	425	404	454	306	123	172	187	22	161	6	158	106	132	205	●	147	37	204	52	92	138	107	156	17	176	250	161	59	281	185	200	348	124	
ROTORUA	152	205	231	266	314	229	187	69	162	263	189	337	316	366	218	241	290	150	125	227	147	276	224	250	117	147	●	150	57	127	55	88	119	34	130	197	213	206	193	303	53	260	242		
TAIHAPE	277	55	110	391	164	79	315	194	179	149	249	339	462	441	491	343	91	140	191	83	185	40	126	74	100	242	37	150	●	207	92	95	178	147	159	20	144	253	185	83	318	153	203	385	92
TAURANGA	137	262	288	251	371	286	196	68	219	261	198	322	301	351	203	298	347	207	182	226	195	324	272	298	102	204	57	207	●	173	112	87	118	39	187	254	258	216	254	178	338	62	245	290	
TAUMARUNUI	188	139	194	302	248	163	292	105	179	168	316	373	352	402	254	175	224	167	30	163	52	210	158	184	153	52	127	92	173	●	72	86	53	136	72	214	230	153	111	229	237	180	296	176	
TAUPO	182	150	176	296	259	174	220	99	107	208	244	367	346	396	248	186	235	95	70	235	92	221	169	195	147	92	55	95	112	72	●	118	127	64	75	142	158	225	151	223	248	108	290	194	
TE AWAMUTU	102	225	280	216	330	249	275	19	225	174	277	287	266	316	168	261	310	213	116	139	138	296	244	270	67	138	88	178	87	86	118	●	31	54	158	260	276	129	197	143	323	141	210	262	
TE KUITI	133	194	249	247	299	218	306	50	234	143	308	318	297	347	199	230	279	222	85	108	107	265	213	239	98	107	119	147	118	53	127	31	●	85	127	269	285	98	166	174	292	172	241	231	
TIRAU	118	214	240	232	323	238	221	35	171	228	223	303	282	332	184	250	299																												



YOU CAN BE SURE OF SHELL



AUCKLAND is New Zealand's largest city with a population of more than 380,000. Queen Street is the main thoroughfare of the central business area. Most of the suburbs are on easy rolling plateau land, dotted with cones of extinct volcanoes. One of these, Mount Eden, is handy to the city and has a motor road to the summit from where a commanding view can be obtained of the whole city and surrounding area.

Both on the city side of the Waitemata Harbour and on the North Shore there are innumerable beaches. The harbour itself, extends into an island-studded gulf, making a wonderful sailing ground for hundreds of pleasure craft. Among the islands are Rangitoto, a perfectly symmetrical volcanic cone rising out of the water, Waiheke, with green hills stretching down to soft sand beaches, and Kawau, a famous holiday resort with a sub-tropical climate.

The War Memorial Museum, standing in parkland and overlooking the city, the Art Gallery and Library and Old Colonists' Museum, the University Building and Government House are famous features of the city.

A short trip to Waitakere Ranges takes the motorist through a choice area of native forest, with giant specimens of Kauri trees close to the road and lovely views from various vantage points.



WELLINGTON, which since the first two decades of organised settlement has been the Capital City, has as its outstanding feature its exceptional harbour. In addition to being one of the finest natural harbours in the world for shipping it is scenically magnificent, whether viewed from high on the surrounding hills, from the waterfront driveway or from a ship coming in to port. The Marine Drive follows the waterfront for some 30 miles, almost without break except for the few miles of the main city and port area. There are a number of beaches inside the harbour easily reached by bus or tram ride and one, Oriental Bay, almost in the centre of the city.

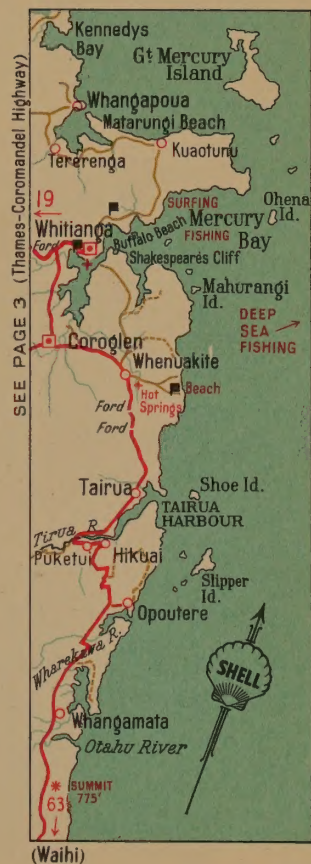
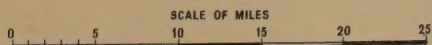
Parliament Buildings and the Dominion Museum and Art Gallery form the most imposing architectural landmarks in Wellington. The Botanical Gardens, which can be reached by bus or by the cable car which climbs out of the city to the hills at Kelburn, consist of more than sixty acres of bush and garden, with beautiful flower displays at appropriate seasons.

The famous Rugby ground, Athletic Park, and the Trentham Racecourse are two of the best equipped sports arenas of their kind in the Dominion.



SCALE: 1 inch = 12½ miles.

- MAIN ROAD - - - - -
- SECONDARY ROAD: Bitumen or metal surface - - - - -
- Formed, not metalled - - - - -
- FOOT TRACK: * * * * * SCENIC ROAD: - - - - -
- DISTANCES: Red figures show miles between dotted towns - - - - -
- or to obvious junctions - - - - -
- NATIONAL PARK BOUNDARY - - - - -
- RAILWAY LINE - - - - -
- MOTOR CAMP ■ HOSPITAL + AERODROME ●

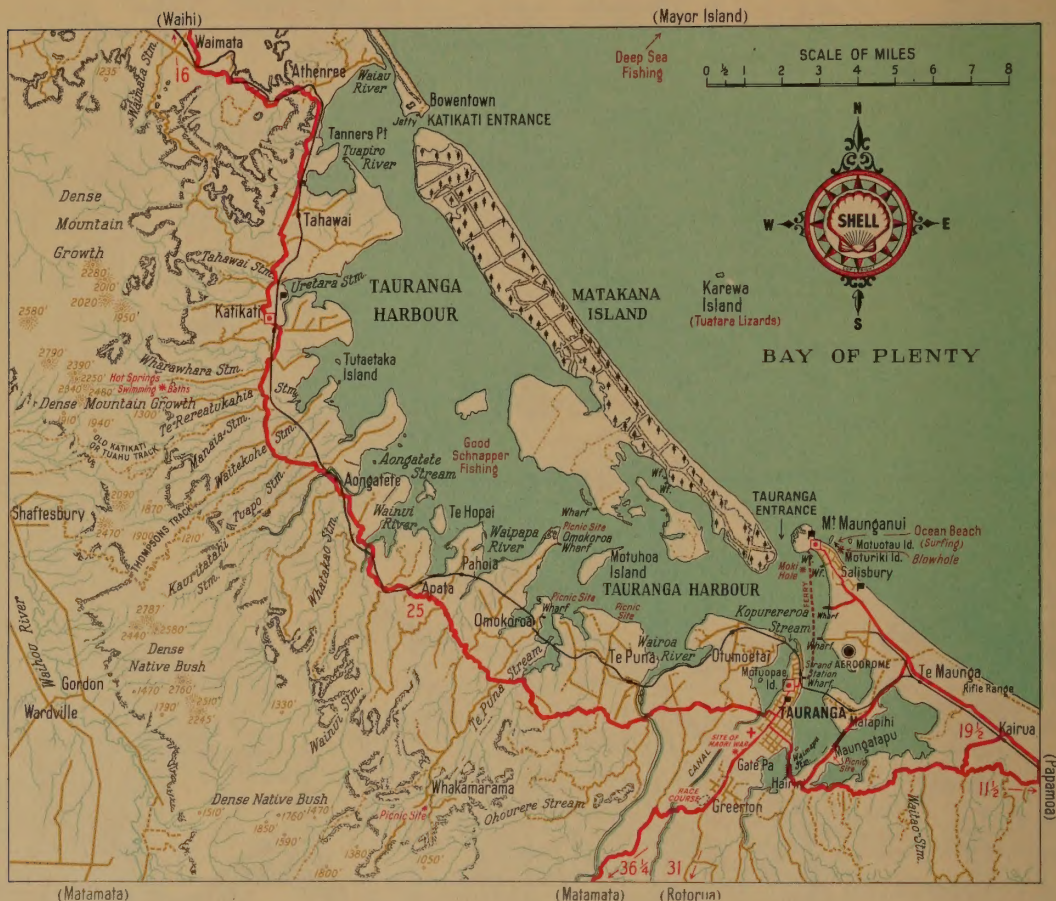












SCALE: 1 inch = $12\frac{1}{2}$ miles.
(Tauranga: 1 inch = $5\frac{1}{2}$ miles)

MAIN ROAD	-	-	-	-	
SECONDARY ROAD: Bitumen or metal surface					
Formed, not metalled	-				
FOOT TRACK:					
SCENIC ROAD:	-				
DISTANCES: Red figures show miles between dotted towns	-	-	-	-	
or to obvious junctions	-	-			
NATIONAL PARK BOUNDARY	-	-			
RAILWAY LINE	-	-	-	-	
MOTOR CAMP					
HOSPITAL					
AERODROME					



8

B

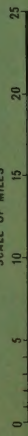
A

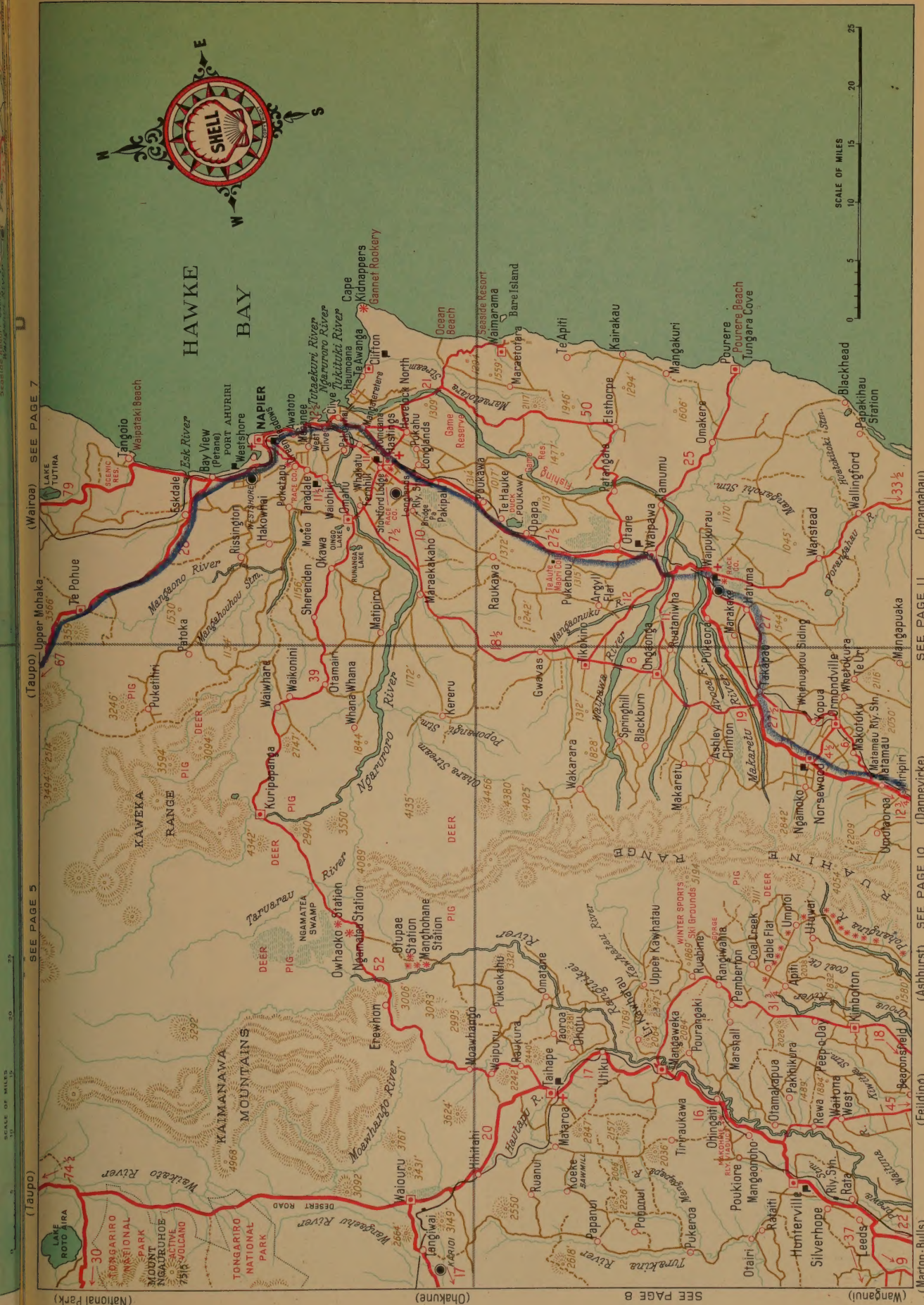


North Taranaki Bight

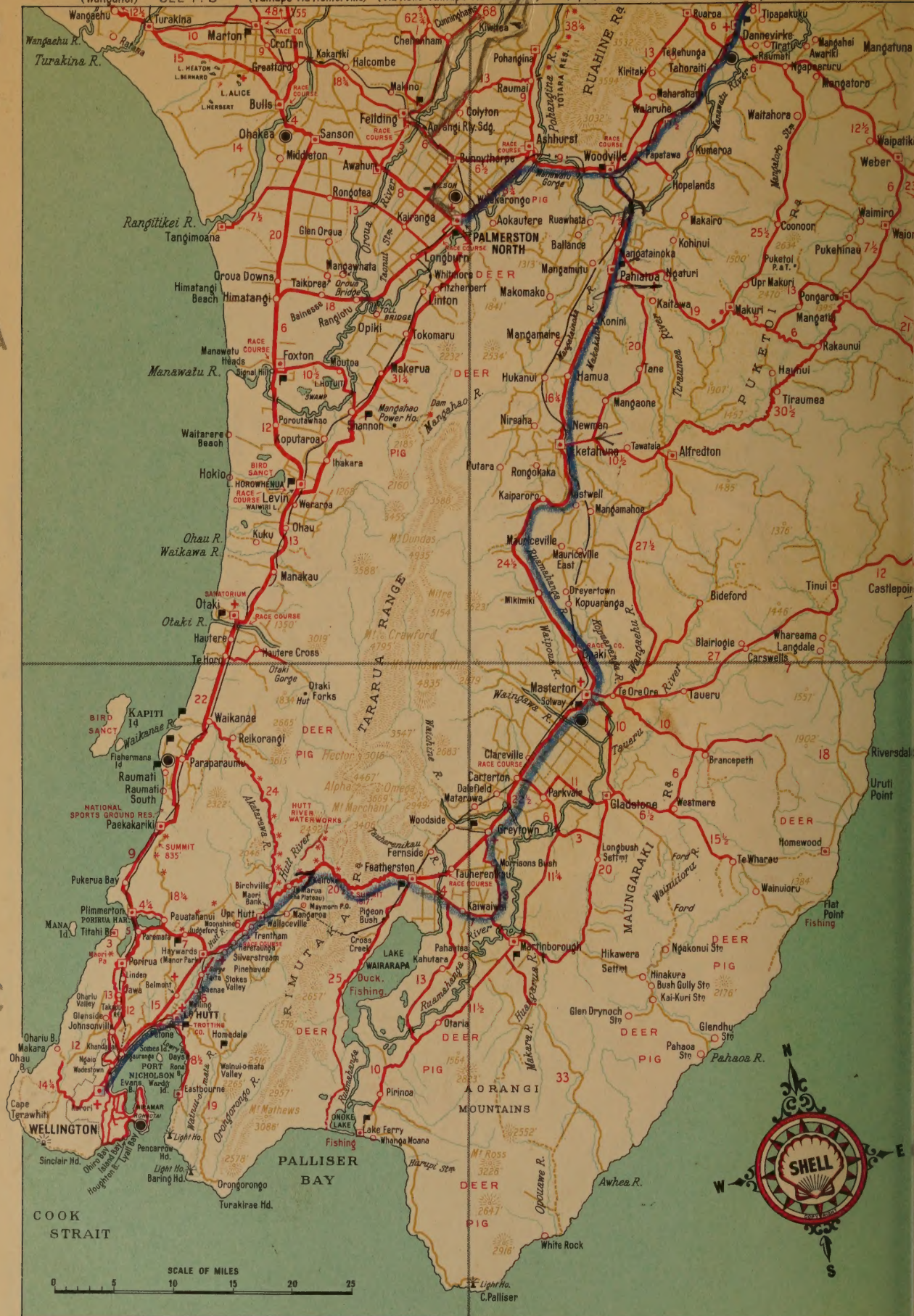
South Taranaki Bight

SCALE OF MILES





SEE PAGE 7 (Wairoa) SEE PAGE 11 (Porangahau) SEE PAGE 10 (Dannevirke) SEE PAGE 8 (Ohakune) SEE PAGE 10 (Ashhurst) SEE PAGE 10 (Feilding) SEE PAGE 10 (Marton-Bulls)



(Suburbs within main city limits are not listed)

	Page	Area		Page	Area		Page	Area		Page	Area
Abbotsford	19	D	Aratiatia Rapids	5	C	Bannockburn	18	D	Boat Harbour (south of Tory Channel entrance, South Island)	11	B
Abel Tasman National Park	12	AB	Aratika	14	A	Bankside	15	C	Bobs Cove	18	C
Abercrombie (Port)	3	B	Arawhata	17	A	Bartletts	7	D	Boddytown	14	A
Abut Head	17	C	Ardmore	3	C	Baring Head	10	C	Bog Roy	18	B
Active Volcano (Ngauruhoe)	9	A	Arden Settlement	7	C	Barryville	4	D	Bog Lake	17	B
Acland Lake	16	A	Ardlussa	20	A	Barrhill	14	A	Bombay	3	C
Adair	16	D	Arero	7	B	Barrhill	15	C	Bortons	19	A
Adams Flat	19	D	Argyll Flat	9	D	Barrys Bay	15	D	Bowtown	3	D
Addison Flat	14	A	Aniki	12	D	Barracouta Point	20	C	Bowlers Creek	19	C
Adelaide Lake	17	B	Aria	4	C	Batley	2	D	Braemar Station	16	C
Adele Island	12	B	Arkles Bay	3	A	Baton	12	B	Brancepeth	10	D
Admiralty Bay	11	B	Arnold	14	A	Baylys Beach	2	C	Bream Bay	2	D
Ahauro	14	A	Arno	16	D	Bay of Islands	2	B	Bream Head	2	D
Ahauro Lake	14	B	Arohana	4	B	Bay of Plenty	6	B	Bream Tail	2	D
Ahimia	3	D	Arowhenua	16	B	" " "	7	A	Brighton	14	A
Ahipara	2	A	Arrowtown	18	C	" " "	5	AB	Brighton	19	D
Ahipara Bay	2	A	Arthurs Pass	14	D	Bay View	9	B	Brightwater	12	B
Ahiiti	4	C	Arthurs Pass National Park	14	BD	Bay of Many Coves	11	B	Bridge Pa	9	B
"	8	A	Arthurs Point	18	C	Bealey	14	D	Brixton	8	A
Ahuri	8	D	Artherton	20	B	Beachlands	3	A	Broadfield	15	D
Ahuriri Flat	20	B	Arundel	16	B	Beaconsfield	9	C	Broadlands	5	C
Ahuriri (Port)	9	B	Ashburton	15	C	Beaumont	19	C	Broadwood	2	A
Ahurua	3	A	Ashburton Airfield	15	C	Beautiful Valley	16	B	Brodys Bay	17	B
Aickens	14	B	Ashburton Forks	15	C	Beatrice Bay	11	B	Brooklands	15	B
Aka Aka	3	C	Ashhurst	10	B	Beachlands	3	A	Brookside	15	C
Akaloa (Little)	15	D	Ashley Clinton	9	C	Becks	18	B	Broomfield	15	A
Akaloa (Little) Bay	15	B	Ashley Downs	20	B	Beef Barrels	11	B	Brooklyn	12	B
Akaroa	15	D	Ashley Bank	15	A	Belgrave	12	B	Brookdale	13	D
Akaroa Harbour	15	D	Ashley Gorge	15	C	Belmont	8	D	Browns	20	C
Akaroa Head	15	D	Ashton	16	B	Belmont	10	C	Browns Bay	3	A
Akaterewa Station	18	B	Ashwick Flat	16	AB	Bell Block	8	A	Browns Island	3	A
Akaterere	2	B	Atahua	15	D	Belfield	16	B	Broughton Bay	11	B
Akerama	2	B	Atapo	12	D	Bell Hill	14	A	Brunnerton	14	A
Akitoi	11	A	Atarau	14	A	Belfast	15	B	Brunner Lake	14	A
Alabaster Lake	17	A	Atene	8	D	Bendigo	18	D	Brunton Lake	20	D
Albany	3	A	Athenree	3	D	Benhopai	13	A	Brunwood	4	B
Albatross Point	4	C	"	6	B	Bennydale	4	D	Brunswick	8	D
Albert Town	18	A	Athol	20	A	Benhar	19	D	Bruce Bay	17	C
Albert (Port)	2	D	Atiamuri	5	C	Bennetts	15	C	Brydone	20	B
Albury	16	D	Atiamuri Airfield	5	C	Benio	20	B	Brydone	20	B
Alexandra	18	D	Atiamuri Upper	5	C	Ben Ohau Station	16	C	Brydone	20	B
Alexandra Airfield	18	D	Atkinson Park	3	A	Ben More	20	A	Brydone	20	B
Alexandrina Lake	16	C	Auckland	3	A	Ben More Station	18	B	Brydone	20	B
Alford Forest	15	C	Auckland (Hobsonville) Airfield	3	A	Ben McLeod Station	16	A	Brydone	20	B
Alfredton	10	B	Auckland (Whenuapai)	3	A	Berghans Point	12	A	Brydone	20	B
Alfriston	3	C	Aerodrome	3	A	Berlins	2	C	Brydone	20	B
Allandale	16	B	Aukopae	4	D	Berwen	18	B	Brydone	20	B
Allanton	19	D	"	8	B	Berwick	19	D	Brydone	20	B
Allenton	15	C	Aurora	18	B	Bethells	3	A	Brydone	20	B
Alligator Head	11	B	Aurora Point	17	B	Bexley	15	C	Brydone	20	B
Allports Island	11	B	Avoca Station	14	D	Bideford	10	B	Brydone	20	B
Alma	19	B	Avondale	3	A	Big Bay	17	A	Brydone	20	B
Alton	8	C	Awaakawako	7	A	Big Bay	11	B	Brydone	20	B
Amberley	15	A	Awahuri	10	A	Big Bay	3	B	Brydone	20	B
Amokura	3	C	Awaiti	12	AB	Big Omaha	3	B	Brydone	20	B
Amodeo Bay	3	B	Awakaponga	5	B	Big River	14	A	Brydone	20	B
Anakoha Bay	11	B	Awakeri	5	B	Birch Grove	20	C	Brydone	20	B
Anakiwa	11	B	Awakino	4	C	Birch Hill	15	A	Brydone	20	B
"	13	A	Awamangu	19	D	Birch Hill	16	C	Brydone	20	B
Anama	15	C	Awamoko	19	A	Birch Hill Station	13	A	Brydone	20	B
Anatoki Forks	12	A	Awamarino	4	C	Birch Park	8	D	Brydone	20	B
Anatimo	12	A	Awani	1	A	Birchville	10	C	Brydone	20	B
Anatoia Bay	11	B	Awanui (Port)	2	A	Birchwood	20	C	Brydone	20	B
Anawhata	3	A	Awaree	19	A	Birdlings Flat	15	D	Brydone	20	B
Anaura Beach	7	B	Awariki	10	B	Birdlings Flat Airfield	15	D	Brydone	20	B
Andersons Bay	19	D	Awaroa Inlet	12	AB	Birkenhead	3	A	Brydone	20	B
Aniwanian	4	B	Awaroa	2	A	Bishops	19	D	Brydone	20	B
Annat	15	C	Awaroa (Waiheke Is.)	3	B	Blackburn	9	C	Brydone	20	B
Aohanga	11	A	Awarua	2	A	Black Head	20	D	Brydone	20	B
Aokautere	10	B	Awarua	2	A	Black Head	19	D	Brydone	20	B
Aongatete	6	B	Awarua	2	A	Blackhead	9	D	Brydone	20	B
Aorangi	7	B	Awarua	2	A	Blackball	14	A	Brydone	20	B
Aorangi Rly. Siding	10	A	Awarua	20	D	Blacks Point	14	A	Brydone	20	B
Aorere	12	A	Awarua Plains	20	D	Blackstone Hill	18	B	Brydone	20	B
Aotea Harbour	4	A	Awarua Bay	20	D	Blackmount Station	17	B	Brydone	20	B
Aoroa	2	C	Awarua Point	17	A	Blackwater	14	A	Brydone	20	B
Aotuhia	8	B	Awatea	20	B	Blairlogie	10	B	Brydone	20	B
Apata	6	B	Awatere	13	B	Bland Bay	2	B	Brydone	20	B
Aparima	20	C	Awatoto	9	B	Blenheim	13	A	Brydone	20	B
Apiti	9	C	Awatuna	14	C	Blenheim (Omaka) Aerodrome	13	A	Brydone	20	B
Appleby	12	B	Awatuna	8	C	Blenheim (Woodbourne) Aerodrome	13	A	Brydone	20	B
Apuau Channel	11	B	Awhitu	3	C	Blind River	13	B	Brydone	20	B
Arahua	14	C	Awhitu Central	3	C	Blockhouse Bay	3	A	Brydone	20	B
Arakihī Station	7	B	Aylesbury	15	C	Blowhole	5	C	Brydone	20	B
Aramiro	4	A	Babylon	2	C	Blowholes	6	B	Brydone	20	B
Aramoana	19	D	Baines	10	A	Blue Lake	14	A	Brydone	20	B
Aramoho	8	D	Bainham	12	A	Bluff	5	A	Brydone	20	B
Aranga	2	C	Balcarr	15	A	Bluff Harbour	20	D	Brydone	20	B
Arapa	4	D	Balclutha	20	B	Blueskin Bay	19	BD	Brydone	20	B
Arapawa Island	11	B	Balfour	20	A	Bluespur	19	C	Brydone	20	B
Arapiro	12	C	Ballance	10	B	Bluecliffs	16	D	Brydone	20	B
Arapohue	2	C	Balmoral	15	A	Bluecliffs	20	C	Brydone	20	B
Arapuni	4	B	Balmoral Station	15	A	Bluecliffs Beach	20	C	Brydone	20	B
Arapuni Lake	4	B	Balmoral Station	15	A	Blumine Island	11	B	Brydone	20	B
Ararimu	3	C	Banks Peninsula	16	D				Brydone	20	B
Ararua	2	D							Brydone	20	B
Aratapu	2	C							Brydone	20	B

	Page	Area		Page	Area		Page	Area		Page	Area
Carew ..	16	B	Colac ..	20	C	Doubtless Bay ..	1	A	Fairfax ..	20	C
Caroline Bay ..	16	B	Colac Bay ..	20	C	..	2	A	Fairfield ..	19	D
Caroline ..	20	A	Collingwood ..	12	A	Douglas Settlement ..	16	D	Fairlie ..	16	BD
Cardiff ..	8	C	Collins Bay ..	18	C	Douglas ..	8	A	Fairton ..	15	C
Cardrona ..	18	C	Colliers Junction ..	8	D	Douglas Lake ..	17	A	Fairy Springs ..	5	A
Carterton ..	10	D	Coleridge ..	14	D	Dovedale ..	12	B	Fairy Bay ..	11	B
Carswells ..	10	B	Coleridge Lake ..	14	D	Doyleston ..	15	D	Fairview ..	16	D
Castor Bay ..	3	A	Coldstream ..	16	B	Dreyerton ..	10	B	Falls ..	2	B
Cass ..	14	D	Colville ..	3	B	Driving Creek ..	3	B	..	3	A
Cashmere Hills ..	15	D	Colville Bay ..	3	B	Dromore ..	15	C	Falls (Waipori) ..	19	D
Castlecliff ..	8	D	Colyton ..	10	A	Drummond ..	20	C	.. (Waikare) ..	4	C
Castlepoint ..	11	A	Conway ..	13	D	Drop Scene (Wanganui R.) ..	8	B	.. (Huka) ..	5	C
Castle Hill Station ..	14	D	Conway Bridge ..	13	D	Drury ..	3	C	.. (Okere) ..	5	A
Castle Hill Station ..	16	C	Conical Hills ..	20	B	Dry Bread ..	18	B	..	7	C
Castle Rock ..	20	A	Cook Hermitage ..	16	C	Dryden Bay ..	11	B	.. (Omanawa) ..	5	A
Cascade Creek ..	17	B	Cook Strait ..	13	B	Duders Beach ..	3	B	.. (Omanawa) ..	8	D
..	18	C	..	10	C	Dumbarton ..	19	C	.. (Rai) ..	13	A
Cascade Point ..	17	A	Coombe Rocks ..	11	B	Dunback ..	19	B	.. (Dorothy) ..	14	C
Catherine Cove ..	11	B	Coonor ..	10	B	Dunedin ..	19	D	.. (Sutherland, Bowen, and Stirling; not incorporated in this series. About 13 miles south-west of the Hostel at head of Milford Sound) ..	17	A
Cattle Valley ..	16	B	Coopers Creek ..	15	C	Dunedin (Taieri) Aerodrome ..	19	D	Farewell Cape ..	12	A
Cavalli Islands ..	2	B	Coopers Beach ..	1	A	Dunearn ..	20	C	Farewell Spit ..	12	A
Cave ..	16	D	..	2	A	Dunmore ..	3	C	Featherston ..	10	C
Caves (Waitomo) ..	4	C	Cora Lynn Station ..	14	D	..	4	A	Feilding ..	10	A
Caves ..	3	C	Corbyvale ..	12	C	Dunsandel ..	15	C	Feldwick ..	20	C
..	8	D	Corinth (or Koriniti) ..	8	D	Dunrobin ..	19	C	Fergusons Bush ..	14	C
..	12	A	Coroglen ..	3	D	Dunroon ..	19	A	Fereday Island ..	15	C
..	14	A	..	1	B	D'Urville Island ..	11	B	Fergus Lake ..	17	B
..	20	C	..	3	B	D'Urville Peninsula ..	11	B	..	18	C
Cecil Peak Station ..	18	C	Coromandel ..	3	A	Duvauchelles ..	15	D	..	20	B
Cecil Lake ..	17	B	Coromandel Harbour ..	3	A	Ealing ..	16	B	Ferndale ..	12	D
Centre Bush ..	20	A	Cornwallis ..	3	A	Earnsclough ..	18	D	Fern Flat ..	9	B
Chalmers (Port) ..	19	D	Cottesbrook ..	19	C	..	10	C	Fernhill ..	3	A
Chaney ..	15	B	Courtenay ..	15	C	Eastbourne ..	20	C	Fernielea ..	10	C
Channel Island ..	3	B	Coutts Island ..	15	A	Eastern Bush ..	3	A	Fernside ..	15	A
Charleston (see margin) ..	14	A	Cowes Bay (Waiheke Is.) ..	3	B	Eastern Beach ..	8	A	Ferntown ..	12	A
Charles Lake ..	20	D	Craigellachie ..	19	C	East End Beach ..	20	B	Fighting Bay ..	11	B
Charlton ..	20	B	Craill Bay ..	11	B	East Chatton ..	20	B	Fiordland National Park ..	17	A
Charing Cross ..	15	C	Creighton Station ..	18	C	East Bay ..	11	B	Fishermans Island ..	10	C
Charwell Forks ..	13	D	Cricklewood ..	7	C	East Cape ..	6	A	Fitzroy Beach ..	8	A
Charteris Bay ..	15	D	Cricklewood ..	16	D	East Entry Point ..	11	B	Fitzroy Bay ..	11	B
Charles (Port) ..	3	B	Crofton ..	10	A	East Head ..	15	BD	Five Forks ..	19	A
Chaslans ..	20	B	Cromwell ..	18	D	East Head ..	11	B	Five Rivers ..	20	A
Chaslans Mistake ..	20	B	Cromwell Airfield ..	18	D	East Head ..	15	C	Fitzherbert ..	10	A
Chateau Tongariro ..	8	B	Cromwell Gorge ..	18	D	East Oxford ..	15	C	Flat Point ..	10	D
Chatton ..	20	AB	Cronadun ..	14	A	East Taieri ..	19	D	Flaxbourne ..	13	B
Chatton East ..	20	B	Croisilles Harbour ..	11	B	East Takaka ..	12	A	Flaxton ..	15	A
Chatto Creek ..	18	D	..	12	B	East Tamaki ..	3	A	Flemington ..	16	B
Cheltenham ..	10	A	Cross Creek ..	10	C	Edendale ..	20	B	Flints Bush ..	20	C
Chetwode Islands ..	11	B	Crookston ..	19	C	Edgecumbe ..	5	B	Fordell ..	8	D
Chertsey ..	15	C	Crown Terrace ..	18	C	Edgecumbe Mt. ..	5	B	Forks (The) ..	17	C
Chesterfield ..	14	C	Croyden ..	20	B	Edgecumbe Point ..	11	B	Forsyth ..	19	C
Cheviot ..	13	D	Croyden Bush ..	20	B	Edievale ..	19	C	Forsyth Island ..	11	B
Chicot Rock ..	11	B	Culdaff Point ..	11	B	Eglinton Valley ..	17	B	Forsyth Bay ..	11	B
Chorlton ..	15	B	Culverden ..	15	A	Egmont Village ..	8	A	Forsyth Lake ..	15	D
Christchurch ..	15	D	Cunninghams ..	10	A	Egmont Mountain House ..	8	C	Fortrose ..	20	D
Christchurch (Harewood) ..	15	C	Curio Bay ..	20	D	Egmont National Park ..	8	AC	Fortification ..	20	D
Aerodrome ..	15	C	Cust ..	15	C	Eifelton ..	16	B	Four Peaks ..	16	B
Christchurch (Sockburn) ..	15	D	Current Basin ..	11	B	Eketahuna ..	10	B	Four Fathom Bay ..	11	B
Aerodrome ..	15	D	..	11	B	Elaine Bay ..	11	B	Foveaux Strait ..	20	CD
Christall Lake ..	14	B	Dacre ..	20	D	Elevation ..	11	B	Fox Glacier ..	16	A
Churchill ..	3	C	Dacre Bay ..	11	B	Elfin Bay ..	18	C	..	17	C
..	4	A	Dairy Flat ..	3	A	Elfin Bay Station ..	18	C	Fox Glacier National Park ..	16	AC
Clandeboyne ..	16	B	Dalefield ..	10	D	Elgin ..	15	C	..	17	C
Claremont ..	16	D	Dalethorpe Station ..	15	C	Elizabeth Point ..	14	A	Fox Glacier Airfield ..	16	A
Clarendon ..	19	D	Dalgetys ..	18	A	Eli Bay ..	11	B	Foxhill ..	12	B
Clarence River ..	13	CDB	Daniells Lake ..	14	B	Ellery Lake ..	17	A	Fox Point ..	17	A
Clarence Bridge ..	13	B	Dannevirke ..	10	B	Ellesmere ..	15	D	Foxton ..	10	A
Clarence Airfield ..	13	B	Dannevirke Airfield ..	10	B	Ellesmere Lake ..	15	D	Frankton Junction ..	4	AB
Clareville ..	10	D	Dansey Pass ..	19	A	Ellerslie ..	3	A	Frankton ..	18	C
Clarks Beach ..	3	C	Dargaville ..	2	C	Elms (The) ..	13	D	Frankton (Queenstown) ..	18	C
Clarks Junction ..	19	D	Darfield ..	15	C	Elsthorpe ..	9	D	Airfield ..	18	C
Clark Island ..	11	B	Dashwood ..	13	B	Elsie Bay ..	11	B	Franz Josef ..	16	A
Clarkville ..	15	A	Dawson Falls House ..	8	C	Elstow ..	3	D	..	17	C
Claudlands ..	4	B	Days Bay ..	10	C	..	4	B	Franz Josef National Park ..	16	AC
Clayton Station ..	16	A	Deborah Bay ..	19	D	Eltham ..	8	C	..	16	A
Clay Point ..	11	B	Deep Creek ..	13	A	Elterwater Lake ..	13	B	Franz Josef Airfield ..	16	A
Claverley ..	13	D	Deep Bay ..	11	B	Endeavour Inlet ..	11	B	..	17	C
Clevedon ..	3	C	Deepwater Cove ..	2	B	Enfield ..	19	A	Fraserstown ..	7	C
Clifton ..	20	D	Denniston ..	12	C	Entrance Island ..	17	B	French Pass ..	11	B
Clifton ..	9	B	Denny Lake ..	16	A	Erewhon ..	9	A	French Farm ..	15	D
Clifton ..	12	A	Devonport ..	3	A	Ermedale ..	20	C	Freshford ..	20	A
Clifden ..	20	C	Diamond Harbour ..	15	D	Erua ..	8	B	Frog Flat ..	12	D
Clinton ..	20	B	Diamond Lake ..	17	A	Esk Head Station ..	14	B	Fruitlands ..	18	D
Clive ..	9	B	..	18	C	Esk Valley ..	16	D	..	17	C
Clive West ..	9	B	Diefenbach Point ..	11	B	Eskdale ..	9	B	..	7	C
Closeburn Station ..	18	C	Dillons Point ..	13	A	Essons Valley ..	11	B	..	11	B
Cloudy Bay ..	13	A	Dillmanstown ..	14	C	Ethelton ..	15	A	..	15	D
Clova Bay ..	11	B	Dipton ..	20	A	Etrick ..	19	C	..	20	A
Clutha River (Molyneux R.) ..	18	ABD	Dispute Lake ..	18	C	Eureka ..	4	B	..	12	D
..	19	C	Dobson ..	14	A	Evansdale ..	19	D	..	18	D
..	20	B	Dog Island ..	20	D	Evans Flat ..	19	C	Gable End Foreland ..	7	B
..	18	D	Donnett ..	15	A	Evans Bay ..	10	C	Gabriels Gully ..	19	C
Clyde ..	7	C	Dome Valley ..	3	A	Eversley ..	16	BD	Galatea ..	5	BD
Clyde North ..	20	B	Dome Isles ..	17	B	Everette Reserve ..	8	A	Galatea Airfield ..	5	B
Clydevale ..	20	B	Donnellis Crossing ..	2	AC	Eyrewell ..	15	C	Galloway ..	18	D
Coal Creek ..	9	C	Dorie ..	15	D	Eyreton ..	15	C	Gannet Rookery ..	9	B
Coal Creek Flat ..	18	D	Dorothy Falls ..	14	C	Eyreton West ..	15	C	Gapes Valley ..	16	B
Coalgate ..	15	C	Double Bay (Qn. Charlotte Sd.) ..	11	B	..	..	..	Garston ..	18	D
Coatesville ..	3	A	Double Bay (Kenepuru Sd.) ..	11	B	Fabians Valley ..	13	A	Gate Pa ..	5	A
Cobden ..	14	A	Double Cove ..	11	B	Fairburns ..	2	A	..	6	B
Cockle Bay ..	11	B	Doubtful Island ..	17	B	Fairdown ..	12	C	Gates of Haast ..	18	A

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Gebbies Pass ..	15	D	Greenstreet ..	15	C	Hawera Airfield ..	8	C	Hope Arm (Te Anau Lake)	17	B
George Lake ..	20	C	Green Valley ..	19	A	Hawke Bay ..	9	B	Hopuruahe Landing ..	5	D
Georgina Lake ..	14	D	Greenfield ..	19	C	" ..	7	C	" ..	7	C
Georgetown ..	19	A	Green Island ..	19	D	Hawks Crag ..	12	C	Hopu Hopu ..	3	C
Geraldine ..	16	B	Green Island ..	19	D	Hawkeswood ..	13	D	" ..	4	A
Geyser Valley ..	5	C	Green Hills ..	13	D	Hawkins ..	15	C	Horahora ..	4	B
Geyser (Waimangu) ..	5	A	Greenhills ..	20	D	Hayes Lake ..	18	C	Hororata ..	15	C
Gibbs ..	17	C	Greenland Reservoir ..	19	C	Haywards (Manor Park) ..	10	C	Horeke ..	2	A
Gibsonstown ..	13	A	Greenvale ..	20	AB	Hazelburn ..	16	B	Horsham Downs ..	4	A
Gibbstown ..	18	D	Greenpark ..	15	D	Hearntown ..	16	B	Horikino ..	4	D
Gillespies ..	17	C	Greerton ..	5	A	Heathcote ..	15	D	Horoera Point ..	6	A
Gimmerburn ..	19	A	" ..	6	B	Heddon Bush ..	20	C	Horohoro ..	5	A
Gisborne ..	7	D	Grenneys Road ..	15	A	Hedgehope ..	20	A	Horotiu ..	3	C
Gisborne Airfield ..	7	D	Greta ..	15	A	Helensville ..	3	A	" ..	4	A
Gladfield ..	20	C	Greymouth ..	14	A	Helena Bay ..	2	B	Horopito ..	8	B
Glade House ..	17	B	Greymouth Airfield ..	14	A	Hells Gate ..	5	A	Horowhenua Lake ..	10	A
Gladstone ..	10	D	Greytown ..	10	D	Henderson ..	3	A	Horrelville ..	15	C
Gladstone ..	14	A	Grove ..	11	B	Henderson Bay ..	1	A	Hornby ..	15	D
Glassevin ..	15	A	Grove Reach ..	11	B	Hendes ..	14	C	Horseshoe Bay ..	11	B
Glen Afton ..	3	C	Grovetown ..	13	A	Henley ..	19	D	Horseshoe Bend ..	19	C
" ..	4	A	Grove Bush ..	20	C	Herbert ..	19	B	Hoteo ..	3	A
Glenary ..	18	D	Guards Bay ..	11	B	Herbertville ..	11	A	Hoteo North ..	3	A
Glenavy ..	16	D	Guide Hill Station ..	16	C	Herekino ..	2	A	Hot Springs Beach ..	1	B
Glenbrook Beach ..	3	C	Gummies Bush ..	20	C	Heretaunga ..	10	C	Hotuiti Lake ..	10	A
Glenbrook ..	3	C	Gunn Lake ..	17	B	Heriot ..	19	C	Houghton Bay ..	10	C
Glenbervie ..	2	D	" ..	18	C	Hermitage (Mt. Cook) ..	16	C	Houhou ..	14	C
Glencoe ..	20	A	Gunns Hut ..	17	A	Heron Lake ..	14	D	Houhou Railway Siding ..	14	C
Glen Eden ..	3	A	Guthrie ..	5	A	Hexton ..	7	D	Houhora ..	1	A
Glendhu Bay ..	18	A	Gwavas ..	9	C	Heyward Point ..	19	D	Houipapa ..	20	B
Glendhu ..	18	A			Hicks Bay ..	6	A	Houto ..	2	C	
Glendhu Station ..	10	D	H aast ..	17	A	Highbank ..	15	C	Howard ..	12	D
Glen Drynoch Station ..	10	D	H aast Pass ..	18	A	Highcliff ..	19	D	Howard Junction ..	12	D
Glenduan ..	12	B	H aast Airfield ..	17	A	Highfield ..	13	D	Howden Lake ..	17	B
Glenham ..	20	D	Hackthorne ..	15	C	Hihitahi ..	9	C	" ..	18	C
Glenhope ..	12	D	Hairini ..	5	A	Hikapu Reach ..	11	B	Howard Lake ..	16	A
Glenledi ..	19	D	" ..	6	B	Hikawera Settlement ..	10	D	Howells Point ..	20	C
Gleniti ..	16	D	Hakana Bay ..	11	B	Hikuai ..	1	B	Howells Roads ..	20	C
Glenmark Station ..	15	A	Hakataramea ..	19	A	Hikuai ..	3	D	Howick ..	3	A
Glenmore Station ..	16	C	Hakataramea Station ..	16	D	Hikumutu ..	4	D	Huapai ..	3	A
Glenkenich ..	20	B	Hakataramea Pass ..	16	D	" ..	8	B	Huarau ..	2	D
Glenpark ..	19	B	Hakateri ..	16	B	Hikurangi ..	2	D	Huhu ..	3	C
Glenore ..	19	D	Hakaru ..	2	D	Hikurangi Bridge ..	2	D	" ..	4	A
Glenorchy ..	18	C	Hakowhai ..	9	B	Hikutaia ..	3	D	Huia ..	3	A
Glenmassey ..	3	C	Hakahaka ..	11	B	Hilderthorpe ..	19	B	Huinga ..	8	C
" ..	4	A	Haldon Station ..	16	C	Hillcrest ..	4	B	Huirangi ..	8	A
Glen Murray ..	4	A	Halcombe ..	10	A	Hillersden ..	13	A	Huiarau Lake ..	7	D
" ..	4	A	Haldane ..	20	D	Hillend ..	19	D	Huiroa ..	8	A
Glenomaru ..	20	B	Haldane Bay ..	20	D	Hillend South ..	20	C	Hukateri ..	1	A
Glen Oroua ..	10	A	Halfway Bay Station ..	18	CD	Hillgrove ..	19	B	Hukateri ..	2	C
Glenroy ..	12	D	Halkett Town ..	15	C	Hillsborough ..	8	A	Huka Falls ..	5	C
Glenroy ..	15	C	Halswell ..	15	D	Hilltop ..	15	D	Hukanui ..	10	B
Glenside ..	10	C	Hallam Cove ..	11	B	Hills Creek ..	18	B	Hukarere ..	14	A
Glentui Bush ..	15	A	Hamama ..	12	A	Hilton ..	16	B	Hukerenui ..	2	BD
Glentanner Station ..	16	C	Hamilton ..	4	B	Himatangi ..	10	A	Hundalee ..	13	D
Glentanner Station (old) ..	16	C	Hamilton ..	19	A	Himatangi Beach ..	10	A	Hunter ..	16	D
Glentunnel ..	15	C	Hamiltons Bay ..	11	B	Hinau ..	14	A	Huntly ..	3	C
Glenure Hill Summit ..	20	A	Hamilton Burn ..	20	A	Hinahina ..	20	B	" ..	4	A
Glorit ..	3	A	Hampden ..	19	B	Hinakura ..	10	D	Hunterville ..	9	C
Goat Island ..	3	B	Hampstead ..	15	C	Hinds ..	16	B	Hunua ..	3	C
Godley Head ..	15	D	Hamurana ..	5	A	Hindon ..	19	D	Hunts Road ..	20	B
Godley Peaks Station ..	16	C	Hamua ..	10	B	Hindon Railway Station ..	19	D	Humphreys ..	14	C
Golden Bay ..	12	A	Hangatiki ..	4	D	Hinuera ..	4	B	Hurunui ..	15	A
Golden Downs ..	12	B	Hangaroa ..	7	C	Hira ..	12	B	Hurleyville ..	8	D
Goldsborough ..	14	C	Hanging Rock ..	16	B	Hiruharama (Jerusalem) ..	7	B	Hutt (Upper) ..	10	C
Gonville ..	8	D	Hanmer ..	13	C	Hiwipango ..	12	B	Hutt (Lower) ..	10	C
Goodwood ..	19	B	Hapuku ..	13	D	Hoanga ..	2	C	Hutt River ..	10	C
Goose Bay ..	13	D	Harakeke ..	12	B	Hobsonville ..	3	A	Hyde ..	19	A
Gore ..	20	B	Harapepe ..	4	A	Hobsonville Airfield ..	3	A	Hydro ..	19	A
Gore Airfield ..	20	B	Harewood ..	15	CD	Hochstetter Lake ..	14	A			
Gorge Bridge ..	15	C	Harewood Aerodrome ..	15	C	Hodderville ..	4	B	I anthe Lake ..	14	C
Gorge Road ..	20	D	Harihari ..	14	C	Hoe-o-Tainui ..	3	D	I da Valley ..	18	B
Gordon ..	4	B	Harper Pass ..	14	B	" ..	4	B	Idaburn Valley ..	18	B
" ..	6	B	Harrisville ..	3	C	Hohonu ..	14	C	Ikamatua ..	14	A
Gordonton ..	3	C	Harringtons ..	20	A	Hokianga Harbour ..	2	A	Ikakara ..	10	A
Gordonton ..	4	B	Hartmount ..	14	A	Hokio ..	10	A	Ikawai ..	16	D
Gore Bay ..	15	B	Hastwell ..	10	B	Hokitika ..	14	C	" ..	19	A
Gore (Port) ..	11	B	Hastings ..	9	B	Hokitika Airfield ..	14	C	Inaba ..	8	C
Goulter Bay ..	11	B	Hastings Airfield ..	9	B	Hokonui ..	20	A	Inangahua Junction ..	12	CD
Goughs Bay ..	15	D	Hatepe ..	5	C	Hollyford Track (along ..			Inangahua Landing ..	12	D
Governors Bay ..	15	D	Hatfield ..	15	C	Hollyford River) ..	17	A	Inchbonnie ..	14	A
Gowan ..	12	D	Hatuma ..	9	D	Hollyford Track ..	18	C	Inch Valley ..	19	B
Gowans Bridge ..	12	D	Hauti ..	7	B	Holmesdale ..	20	A	Inchlutha ..	20	B
Graham Point ..	12	B	Haumoana ..	9	B	Homebush ..	11	B	Inglewood ..	8	A
Grahams Beach ..	3	AC	Hauui ..	10	B	Homebush ..	15	C	Invercargill ..	20	C
Grampian Station ..	16	C	Hauraki Gulf ..	3	B	Homebrook ..	7	A	Invercargill Airfield ..	20	C
Granity ..	12	C	Haupiri ..	14	B	Homedale ..	10	C	Irwell ..	15	D
Granville ..	14	A	Haupiri Lake ..	14	AB	Homewood ..	10	D	Irishmans Creek Station ..	16	C
Grassmere Lake ..	13	B	Hautapu ..	4	B	Homewood Bay ..	11	B	Island Bay ..	10	C
Grays Hill Station ..	16	C	Hautanoa ..	7	B	Homer Tunnel ..	17	B	Island Bay ..	11	B
Greatford ..	10	A	Hautere ..	10	A	Homers Saddle ..	17	B	Island Cliff ..	19	A
Great Barrier Island ..	3	B	Hautere Cross ..	10	A	Hongi's Track ..	5	A	Island Block ..	19	C
Great Exhibition Bay ..	1	A	Hauturu ..	4	A	Honikiwi ..	4	AC	Islands, Bay of ..	2	B
Great Mercury Island ..	1	B	Hauwai ..	13	B	Hoopers Point ..	1	A	Islay Downs ..	19	A
Great Island ..	15	CD	Havelock ..	11	B	Hook ..	16	D	Isla Bank ..	20	C
Greendale ..	15	C	" ..	13	A	Hook (Upper) ..	16	D	Islington ..	15	CD
Greenhithe ..	3	A	Havelock North ..	9	B	Hooks Beach ..	3	B	Iwihoa ..	7	A
Green Lane ..	3	A	Hawai ..	7	A	Hoopers Inlet ..	19	D			
Green Lake ..	5	A	Hawea Flat ..	18	A	Hopelands ..	10	B	J ackson (Port) ..	3	B
Greenmeadows ..	9	B	Hawea Lake ..	18	A	Hope ..	12	B	J acksons ..	14	B
Greenstone ..	14	C	Hawarden ..	15	A	Hope Pass ..	14	B	J acksons Head ..	17	A
Greenstone Station ..	18	C	Hawera ..	8	C	Hope Saddle ..	12	D	J acksons Bay ..	17	A

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Jackson (Cape)	11	B	Karak	3	C	Ki-wainono Lagoon	16	D	Leefield	13	A
Jasper Lake	13	A	Karakariki	4	A	Kiwitahi	4	B	Le Bons Bay	15	D
Jerusalem (Hiruharama)	7	B	Karama	12	C	Kiwirea	10	B	Leeston	15	D
Jerusalem	8	D	Karama Airfield	12	C	Kiwi	12	D	Lee Stream	19	D
Johnsonville	10	C	Karama Bight	12	C	Knapdale	20	B	Lees Valley	15	A
Johnson Lake	18	C	Karamu	4	A	Knobs Flat	17	B	Leigh (Little Omaha)	3	B
Jordan	2	D	Karangarua	17	C	"	18	C	Leithfield	15	A
Jordan	13	A	Karangahake	3	D	Koeke	9	C	Lemon Point	4	C
Jollies Pass	13	C	Karapiro	4	B	Kohekohe	3	C	Lepperton	8	A
Jordy Rocks	11	B	Karapiro Lake	4	B	Kohinui	10	B	Lepperton Junction	8	A
Josephville	20	A	Karewa Island	6	B	Kohukohu	2	A	Leslie Hills Station	15	A
Judgeford	10	C	Karetu	2	B	Kohumaru	2	A	Levels	16	B
Kaawa	3	C	Karekare	3	A	Kohimarama	3	A	Levin	10	A
Kaaka	4	A	Karikari (Cape)	1	A	Kohua Road	4	D	Levy (Port)	15	D
Kaaka	2	CD	Karitane	19	B	Kohuratahi	8	B	Lewis Pass	14	B
Kaao	2	B	Kartigi	19	B	Kohi	8	D	Lichfield	4	B
Kaharoa	5	A	Karioi	8	B	Kokako	3	A	Ligar (Port)	11	B
Kahikatea	14	A	Karioi Airfield	9	A	Kokatahi Lower	14	C	Lillybank Station	16	A
Kahoe Bridge	2	B	Karori	10	C	Kokiri	14	A	Limehills	20	A
Kahora	5	A	Katanga	12	D	Kokonga	19	A	Lincoln	15	D
Kahutara	10	C	Katea	20	B	Kokopu	2	D	Linden	10	C
Kahui Road	8	C	Katikati	4	B	Komakorau	3	C	Lindis Crossing	18	B
Kahuika	20	B	"	6	B	"	4	A	Lindis Pass	18	B
Kaiaka	2	A	Katikati Entrance	6	B	Komata	3	D	Linnburn	19	C
Kaiapoi	15	A	Katui	2	A	Komata North	3	D	Linton	10	A
Kaiata	14	A	Kauaeranga	3	D	Komako	19	A	Lismore	16	B
Kaiaua	3	D	Kauana	20	A	Kongahu	12	C	Little Akaloa	15	D
Kaihere	3	D	Kaukapakapa	3	A	Kongahu Point	12	C	Little Akaloa Bay	15	D
Kaihiku	20	B	Kauauroa Bay	11	B	Konini	10	B	Little Omaha (Leigh)	3	B
Kaihinu Railway Siding	14	C	Kauangaroa	8	D	Kononi	19	C	Little Barrier Island	3	B
Kaihu	2	C	Kaupokonui	8	C	Kopaki	4	D	Little Valley	18	D
Kai-iwi	8	D	Kauri	2	D	Kopu	3	D	Little River	15	D
Kaikohe	2	A	Kauroa	4	A	Kopua	9	C	Little Wanganui	12	C
Kaikohe Airfield	2	A	Kauru Hill	19	A	Kopuarahi	3	D	Little Rakaia	15	D
Kaikou	2	BD	Kawakawa	2	B	Kopuaranga	10	B	Livingstone	19	A
Kaikoura	13	D	Kawa Kawa Bay	6	A	Kopuwhara	7	D	Loburn	15	A
Kaikoura Peninsula	13	D	Kawakawa Bay	3	D	Kopuku Settlement	3	C	Loburn North	15	A
Kai-kuri Station	10	D	Kawatiri	12	D	Kopuriki	5	B	Lochiel	20	C
Kaimai	5	A	Kawau Landing	3	A	Koputaroa	10	A	Lochinvar Old Station	14	B
Kaimai Lower	5	A	Kawau Bay	3	A	Koputauaki	3	B	Lochnagar Bay	11	B
Kaimiro	8	A	Kawau Island	3	B	Korakonui	4	B	Lochnagar	17	A
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Otahu	20	C	Pakatoa Island	3	B	Pehu	8	A	"	9	B
Otahuhu	3	A	Pakawau	12	A	Pekatahi	5	B	Port Ahuriri	6	A
Otahuti	20	C	Pakawau Inlet	12	A	Pekerau	2	A	Port Awanui	19	D
Otaika	2	D	Pakahi Island	3	D	"	1	A	Port Chalmers	3	B
Otaio	16	D	Pakihiroa	7	B	Pelorus Bridge	13	A	Port Charles	11	B
Otairi	9	C	Pakihikura	9	C	Pelorus Sound	11	B	Port Gore	3	B
Otakou	19	D	Pakipaki	9	B	"	13	A	Port Jackson	2	D
akeho	8	C	Pakiri	3	B	Pemberton	9	C	Portland	7	D
aki	10	A	Pakotai	2	C	Pencarrow Head	10	C	Portland Island	11	B
Otaki Gorge	10	C	Pakowhai	9	B	Pendarves	15	C	Port Ligar	20	B
Otaki Forks	10	C	Pakuranga	3	A	Pendle Hills Station	15	A	Port Molyneux	10	C
Otakiri	5	B	Palliser Bay	10	C	Penguin Bay	11	B	Port Nicholson	14	D
Otama	20	A	Palliser Cape	10	D	Penrose Junction	3	A	Porters Pass	15	D
Otamaire	9	A	Palmerston	19	B	Pentland Hills Station	16	D	Port Lyttelton	15	D
Otamakapua	9	C	Palmerston North	10	A	Pepepe	3	C	Port Levy	15	D
arakau	5	A	Palmerston (Milon) Aerodrome	10	A	"	4	A	Portobello	19	D
umita	20	A	Pamapurua	2	A	"	12	B	Port Robinson	15	B
Otane	9	D	Pancake Rock Formations	14	A	Pepin Island	12	B	Port Waikato	4	A
Otanerua Bay	11	B	Pandora	1	A	Peraki Bay	15	D	"	3	C
Otangaoroa	2	A	Pangatotara	12	B	Peria	2	A	Port Underwood	11	B
Otangiwa	4	D	Panmure	3	A	Perpendicular Point	1	A	"	13	A
Otanomomo Railway Siding	20	B	Panguru	3	A	Petane (Bay View)	9	B	Potaka	6	A
Otapiri Gorge	20	A	Papakao	19	AB	Petone	10	C	Pouawa	7	B
Otara	7	A	Papakihau Station	9	D	Phoebe	13	D	Poukawa	9	D
Otara	20	D	Papakura	3	C	Piano Flat	18	D	Poukawa Lake	9	D
Otarawao	11	B	Papamoa	5	A	Piarere	4	B	Poukioere	9	C
Otarua	20	B	Papanui	9	C	Pickersgill Island	11	B	Pounawea	20	B
Otarua	10	C	Papanui Inlet	15	D	Picton	13	A	Pourangaki	9	C
Otatara	20	C	Paparangi	8	D	"	11	B	Pourere	9	D
Otaua	3	C	Paparata	3	C	Pigeon Bush	10	C	Pouere Beach	9	D
Otaua	2	A	Paparatua	8	D	Pigeon Bay	15	D	Pourewa Island	7	B
Otautau	20	C	Paparatua Saddle	8	B	Pigeon Bay	15	D	Pouto	2	C
Otautu	3	B	Paparatua	7	C	Pigeon Island	18	C	Poverty Bay	7	D
Otekaikae	19	A	Paparamu	3	C	Pigeon Flat	19	D	Prebbleton	15	D
okura	20	B	Paparoa	2	D	Pig Root	19	A	Prices Corner	12	B
Utematata	18	B	Paparoa Railway Station	2	D	Pig Island (L. Wakatipu)	18	C	Puahue	4	B
Otewa	4	D	Paparore	1	A	Pig Island	20	C	Puahua	15	D
Otiakae	19	A	Papatata	10	B	Pihia	3	A	Puerua	20	B
Otipua	16	D	Papatowai	20	B	Pihama	8	C	Puha	7	B
Otiria Junction	2	B	Papatotara	20	C	Pikariki	8	B	Puhi Puhi	2	B
tira	14	D	Papatoetoe	3	A	Pikowai	5	B	Puhi Puhi	13	D
Tunnel	14	D	Papawai Bay	11	B	Pine Bush	10	C	Puhoi	3	A
ige	14	D	Paponga	2	A	Pinnacle Rock	20	D	Pukahu	9	B
ia	19	D	Paradise	17	A	Pinohia	3	B	Pukaki	16	C
otoko	7	A	"	18	C	"	11	B	Pukaki Lake	16	C
Otoko	8	D	Paradise Valley	5	A	"	13	A	Pukapuka Point	3	A
Otonga	2	D	Para	13	A	Piopio	4	C	Pukearuhe	8	A
Otoroa	2	B	Parahi	2	C	Pipiriki	8	D	Puketapu	9	B
Otorohanga	4	D	Parakao	2	C	Pipiroa	3	D	Pukeatua	4	B
Ototoa Lake	3	A	Parakai	3	A	Pipiwai	2	D	Pukeatea Bay	11	B
Otukai	1	A	Paranui	2	A	Pirinoa	10	C	Pukeawa	20	B
"	2	A	Parapara	1	A	Piripiri	9	C	Pukehiki	19	D
Otumoetai	5	A	"	2	A	Piripiri	4	C	Pukehinaiu	10	B
"	6	B	Parapara Inlet	12	A	Piraka	4	D	Pukeho	8	A
Otupae Station	9	A	Paraparaumu	10	C	Pirongia	4	B	Pukehou	9	D
rehua	18	B	Paraparaumu Aerodrome	10	C	Pleasant Flat	18	A	Pukehika	2	C
ru	2	A	Parau	3	A	Pleasant Valley	16	B	Pukeiti Rhododendren Garden	8	A
ue	2	A	Parawa	20	A	Pleasant Point	16	B	Pukekawa	3	C
uruhia	15	B	Parawai	3	D	Pleasant Bay	17	B	"	4	A
utram	19	D	Parawera	4	B	Plimmerton	10	C	Pukekama	19	D
Overdale	15	C	Parengarenga Harbour	1	A	Poerua	14	A	Pukekapia	3	C
Oviemore Station	18	B	Paremata	10	C	Poerua Lake	14	A	"	4	A
Owaka	20	B	Pareora	16	D	Pohangina	10	B	Pukekoikoi	11	B
Owaka Valley	20	B	Pareora Gorge	16	D	Pohara Beach	12	A	Pukekohe	3	C
Owhango	4	D	Paretai	20	B	Pohokura	8	B	Pukemaori	20	C
"	8	B	Parihaka	8	C	Pohokura Saddle	8	B	Pukemako	4	D
Owharoa Railway Siding	3	D	Parikino	8	D	Pohouui	9	C	Pukemiro	3	C
Owen Junction	12	D	Parihouhou	8	D	Pohuehue	3	A	"	4	A
Owen River	12	D	Parikawa Siding	13	B	Point Elizabeth	14	A	Pukenui	1	A
Owen Valley	12	D	Paringa Lake	17	C	Pokahinu Point	7	A	Pukengahu	8	C
Owhaoko Station	9	A	Parkhurst	3	A	Pokaka	8	B	Pukeokahu	9	C
Owhareti Lake	2	B	Park Hill	19	C	Pokororo	12	B	Pukeroa	9	D
Owhiwa	2	D	Parkvale	10	D	Pokapu	2	B	Pukeora	9	D
Oxford (East)	15	C	Parnassus	13	D	Pokapu Railway Station	2	B	Pukeoware	3	C
Oxford (West)	15	C	Paroa	14	A	Pokeno	3	C	Pukekura	14	C
Oxford Forest	15	C	Parore	2	C	Pokere	2	B	Pukepito	20	B
Oyster Bay	11	B	Parua	2	D	Pokuru	4	B	Pukepouru	19	A
"	9	D	Patangata	2	D	Pollok	3	C	Pukepoto	2	A
Paekakariki	10	C	Pataua	2	D	Pomahaka	20	B	Pukerangi	19	D
Paemako	4	D	Patea	8	D	Pompolona Huts	17	B	Pukerau	20	B
Paenga	12	C	Patearoa	19	A	Pongakawa	5	A	Pukeroro	4	B
Paengaroa	5	A	Paterangi	4	B	Pongakawa Valley	5	A	Pukeria Bay	10	C
erata	3	C	Patetonga	4	B	Pongaroa	10	B	Puketaha	4	B
eroa	3	D	"	3	D	Ponui Island	3	BD	Puketapu	9	B
aerau (Styx) Bridge	19	C	Patience Bay	17	B	Poolburn	18	D	Puketaraki	19	B
Paetawai	2	D	Patoka	9	A	Poolburn Reservoir	19	C	Puketi	2	A
Paewhenua	4	D	Patten Passage	11	B	Popotunua	20	B	Puketitiri	9	A
"						Porangahau	11	A	Puketiro	20	B

	Page	Area		Page	Area		Page	Area		Page	Area
Puketoi	10	B	Rangitoto	4	D	Roto	8	B	Seaview	13	B
Puketoi	19	A	Rangitukia	6	A	Roto Aira Lake	5	C	Seaview	15	C
Puketona	2	B	Ranguru	5	A		9	A	Seaward Downs	20	D
Puketowai	15	A	Rangiwahia	9	C	Roto Ehu Lake	5	A	S.E. Bay	11	B
Puketui	1	B	Rapahoe	14	A	Rotoiti	5	A	Seddon	13	B
	3	D	Rapanui	8	D	Roto Iti Lake	5	A	Seddonville	12	C
Puketutu Island	3	A	Rapaura	13	A	Rotoiti Lake	12	D	Sedgemere	15	D
Puketutu	4	D	Rarangi	13	A	Rotokakahi	2	A	Sefton	15	A
Puketurua	4	B	Rata	9	C	Rotokakahi Lake	5	A	Selwyn	15	C
Pukeuri Junction	19	B	Rataiti	9	C	Rotokare Lake	8	C	Selwyn Island	3	B
Punakaiki	14	A	Ratana	10	A	Roto Kawanu Lake	5	A	Sentry Hill	8	A
Punakitere	2	A	Ratanui	20	B	Rotokino Lake	17	C	Separation Point	12	A
Punaruhi	2	B	Ratapiko	8	A	Rotokohu	12	D	Serpentine	19	C
Pungarehu	8	C	Raukawa	9	D	Roto Ma Lake	5	AB	Sergeants Hill P.O.	12	C
Punihou	8	A	Raukokore	6	A	Rotoma	5	AB	Sergeants Hill Rly. Sdg.	12	C
Puni	3	C	Raukura	9	C	Rotomanu	14	A	Shaftesbury	4	B
Puniwhakau	8	B	Raumati	10	B	Rotomahana Lake	5	A		6	B
Puponga	12	A	Raumati Beach	10	C	Roto Ngaro Lake	3	C	Shag Point	19	B
Pu Pu Springs	12	A	Raumati South	10	C		4	A	Shakespeare Bay	11	B
Pupuke	2	B	Raumai	10	B	Roto Ngaio Lake	5	C	Shakespeares Cliff	1	B
Purangi	8	A	Raupunga	7	C	Rotongaro	3	C	Shannon	10	A
Purakanui	19	D	Raureka	19	D		4	A	Sheffield	15	C
Purakaunui Bay	20	B	Raurimu	8	B	Rotoorangi	4	B	Sheppard Lake	14	B
Purakauti	20	B	Rawene	2	A	Rookwood Station	15	C	Sherenden	9	B
Puramahoi	12	A	Rawhia	2	A	Rotorua Island	5	A	Sheriff River	12	B
Purapura	3	C	Rawhitiroa	8	C	Rotorua	5	A	Sherwood	15	C
Purau	15	D	Rawhitiroa	2	B	Rotorua Airfield	5	A	Sherwood Downs	16	A
Purekireiki	20	B	Razor Back	3	C	Roto Rua Lake	4	B	Ship Cove	11	B
Pureora	4	D	Redan	20	B	Rototuna	12	D	Shirley	15	D
Purerua	2	B	Redcliffs	15	D	Rotorua Lake	3	C	Shoe Island	1	B
Puriri	3	D	Redcliffs	19	A	Rotowaro	4	A	Shotover Lower	18	C
Purua	3	D	Redcliff Station	17	B	Round Hill	20	C	Signal Hill	10	A
Puru	3	D	Red Hill	2	C	Rowan	8	C	Silverdale	3	A
Putangahau	20	D	Redwoods Valley	12	B	Roxburgh	19	C	Silverhope	9	C
Putara	10	B	Redwoodtown	13	A	Roxburgh Hydro-Electric	18	D	Silverstream	10	C
Putaruru	4	B	Redwood Pass	13	AB	Ruahine	9	C	Simons Pass Station	16	C
Putere	5	D	Redvale	3	A	Ruakaka	2	D	Sinclair Head	10	C
Putorino Railway Station	7	C	Reef Point	2	A	Ruakaka Bay	11	B	Sixmile	12	C
Puwhera	2	D	Reefton	14	A	Ruakituri	7	C	Skippers	18	D
			Rehia	2	C	Ruakituri Upper	7	C	Skipton	16	D
Quarry Hills	20	D	Rehuta	2	C	Ruakiwi	3	C	Slipper Island	1	B
Queen Charlotte Sound	11	B	Reidston	19	B		4	A	Slope Point	20	D
"	13	A	Reikorangia	10	C	Ruakura Junction	4	B	Smith Sound	17	B
Queensberry	18	B	Remarkables, The	18	CD	Ruamahanga River	10	BDC	Snag Bay	17	B
Queenstown	18	C	Renown	4	A	Ruamuri	9	C	Snowden Station	15	C
Queenstown (Frankton) Airfield	18	C	Renwicktown	13	A	Ruapehu Mountain	8	B	Sockburn	15	D
			Repongaere Lake	7	D	Ruapeka	2	B	Sockburn Aerodrome	15	D
Rabbit Island	11	B	Reporoa	5	C	Ruapuke	4	A	Solway	10	D
Rabbit Island	12	B	Reporua	6	A	Ruapuke Island	20	D	Somerton	15	C
Racecourse Hill	15	C	Rere	7	A	Ruapuna	16	B	Somes Island	10	C
Raes Junction	19	C	Rere Lake	18	C	Ruatangata	5	D	South Arm (Lake Manapouri)	17	B
Raetihi	8	B	Rerewhakaia Lake	5	AB	Ruatangata	2	D	South Beach (Geymouth)	14	A
Raglan	3	C	Resolution Bay	11	B	Ruataniwha	9	CD	South Beach (Westport) Airfield	12	C
Raglan Airfield	4	A	Rewa	9	C	Ruatapu	14	C	Southburn	16	D
Raglan Harbour	4	A	Rewanui	14	A	Ruatoki	5	B	Southbridge	15	D
Rahotu	8	C	Rewiti	3	A	Ruatoria	7	B	Southbrook	15	A
Rahu	14	B	Rhohoro Downs Station	16	C	Ruatorua	10	B	South Channel (Kawau Bay)	3	B
Rahui Railway Siding	12	C	Riccarton	15	D	Ruatiti	8	B	South Fiord (Lake Te Anau)	17	B
Raio	1	A	Riccarton Upper	15	D	Ruaiti	2	C	South Head (Kaipara)	3	A
Rai Saddle	12	B	Richmond Brook	13	AB	Ruawai	2	C	South Head (Manukau)	3	A
Rai Valley	13	A	Richmond	12	B	Ruawaro	3	C	South Head (Waikawa)	20	D
Railway Spiral	8	B	Richmond Bay	11	B		4	A	South Hillend	20	C
Raincliff	16	B	Richmond Station	16	A	Ruawhata	10	B	South Malvern		
Rainbow Springs	5	A	Rimu	14	C	Ruby Bay	12	B	Railway Siding	15	C
Rainbow Reach	17	B	Rimutaka Summit	10	C	Rukui	2	D	South Mavora Lake	17	B
Rainbow Mount	5	A	Ringway Rly. Siding	20	C	Rukuhia Swamp	4	B	South Taranaki Bight	8	C
Rakaia	15	C	Ripia	2	C	Rukuhia	4	B	South Wharepapa	4	B
Rakaia River	14	D	Riponui Pa	2	D	Rukuhia Airfield	4	B	South Wyndham	20	B
"	15	CD	Rira	4	D	Runanga	14	A	South West Arm		
Rakaunui	10	B	Rissington	9	B	Runanga Lake	9	B	(Lake Te Anau)	17	B
Rakau	12	B	Riverlea	8	C	Runaruna	2	A	Spar Bush	20	C
Rakaubauka	20	C	Riverhead	3	A	Runciman	3	C	Spencerville	15	B
Rakauroa	7	A	Riversdale	10	D	Rununder Point	11	B	Spirits Bay	1	A
Rakautao	2	B	Riversdale	20	A	Rutherglen	19	D	Spotswood	13	D
Rakino Island	3	B	Riverslands	13	A	Ruru	14	A	Springbank	15	A
Ramarama	2	D	Riverton	16	B	Russell	2	B	Springbrook	16	D
Ranganui	8	B	Riwaka	20	C	Russells Flat	15	C	Springburn	15	C
Rangataua	1	A	Roa	14	A	Ryall Bush	20	C	Springdale	4	B
Rangaunui Bay	2	A	Robertson Point	11	B				Spring Creek	13	A
"	19	A	Robin Hood Bay	11	B	Saies	2	B	Springfield	15	C
Rangi	4	D	Robinsons Bay	15	D	Salisbury	16	D	Spring Grove	12	B
Rangi Point	2	A	Rocklands	19	C	Saltwater Creek	15	A	Springhill	9	C
Rangiahua	2	A	Rock & Pillar	19	A	Saltwater Lagoon	17	C	Springhills	20	C
Rangiatea	8	D	Rockville	12	A	Sandy Bay	2	D	Springs Junction	14	B
Rangikura	15	A	Rollesby Station	16	C	Sandy Bay	11	B	Springlands	13	A
Rangiora	10	A	Rolleston	15	C	Sandy Bay	12	B	Springston	15	D
Rangiotu	1	A	Romahapa	20	B	Sandy Knolls	15	C	Springston South	15	D
Rangiputa	3	C	Rona Bay	10	C	Sandy Mount	19	D	Spye Railway Siding	15	A
Rangiriri	4	A	Rongahere	19	C	Sanson	10	A	Squally Bay	15	D
"	5	D	Rongokaka	10	B	Sarah Lake	14	D	Squally Cove	11	B
Rangitaiki	16	B	Rongotai (Wellington)	10	C	Sauvage Point	11	B	Stafford	14	C
Rangitaiki River	16	B	Aerodrome	10	C	Sawdon Station	16	C	Staircase	15	C
Rangitata Island	16	AB	Rongotea	10	A	Saxton Pass	13	C	St. Andrews	16	D
Rangitata	2	A	Ros	14	C	Scargill	15	A	Stanley Brook	12	B
Rangitahi	9	AC	Rosell	16	D	Scenic Drive (Waitakere)	3	A	State Forest Plantation	5	BD
Rangitikei River	10	A	Roslyn Bush	20	C	Scott Point	11	B	Station Lake	14	B
"	3	A	Rotherham	15	A	Scotts Gap	20	C	Staveley	15	C
Rangitoto Island	3	A	Roto	4	D	Seacliff	19	B	St. Bathans	18	B
						Seadown	16	B	St. Clair	19	D
						Seafeld	15	C	Stewart Island		
						Sealy Pass	16	A	(Marlborough Sounds)	11	B

	Page	Area		Page	Area		Page	Area		Page	Area
St. Heliers ..	3	A	Tanekaha ..	2	D	Te Akau ..	4	A	Te Reinga ..	7	C
Stillwater Junction ..	14	A	Tangahoe Valley ..	8	C	Te Akau Wharf ..	3	C	Teremakau ..	14	C
Stirling ..	20	B	Tangaihi ..	2	C	" ..	4	A	Tererenga ..	1	B
St. Johns Hill ..	8	D	Tangarakau Gorge ..	8	B	Te Anga ..	4	C	Te Rerenga ..	3	D
St. Kilda ..	19	D	Tangarakau ..	8	B	Te Anau ..	17	B	Te Rimu ..	8	D
St. Leonards Station ..	15	A	Tangihua ..	2	D	Te Anau Downs Station ..	17	B	Te Rore ..	4	A
Stockton ..	12	C	Tangimoana ..	10	A	Te Anau Lake ..	17	B	Te Roti ..	8	C
Stoke ..	12	B	Tangitioria ..	2	D	" ..	18	C	Te Rou ..	13	A
Stokes Valley ..	10	C	Tangiwha ..	9	A	Te Apiti ..	9	D	Teschemakers ..	19	B
St. Omer ..	11	B	Tangitutu ..	4	D	Te Arai ..	2	D	Te Taho ..	17	C
Stoneburn ..	19	B	Tangoio ..	9	B	Te Arai Bluff ..	1	A	Te Teko ..	5	B
Stoneyhurst ..	15	B	Tangonge Lake ..	2	A	Te Arai Settlement ..	7	D	Te Tipua ..	20	B
Stortford Lodge ..	9	B	Tangowahine ..	2	C	Te Araroa ..	6	A	Te Tio ..	2	A
Strandon Beach ..	8	A	Taniwha ..	3	D	Te Aroha ..	3	D	Te Toro ..	3	C
Stratford ..	8	C	" ..	4	A	" ..	4	B	Te Tua ..	20	C
Stratford Airfield ..	8	C	Tanners Point ..	6	B	Te Atatu ..	3	A	Te Uku ..	4	A
Stratford Mountain House ..	8	C	Taoroa ..	9	C	Te Aute Maori College ..	9	D	Te Uri ..	9	C
Strathmore ..	8	AB	Tapairu ..	4	D	Te Awamutu ..	4	B	Teviot ..	19	C
Streamlands ..	3	A	Tapuanui ..	20	B	Te Awanga ..	9	B	Tewaewae ..	20	C
Struan ..	16	D	Tapapa ..	4	B	Te Awarua ..	4	C	Tewaewae Bay ..	20	C
Stuarts Railway Siding ..	20	B	Tapawera ..	12	B	Teddington ..	15	D	Te Wera ..	8	B
Studholme Junction ..	16	D	Tapuwerao ..	7	B	Te Hachaenga ..	5	A	Te Whaiti ..	5	D
Styx (Paerau) Bridge ..	19	C	Tapu ..	3	D	Te Hana ..	2	D	Te Whetu ..	5	A
Styx Railway Siding ..	15	D	Tapuhi ..	2	B	Te Hapua ..	1	A	Te Whakarae ..	4	D
Sullivans Bridge ..	12	D	Teradale ..	9	B	Te Haroto ..	5	D	Te Wharau ..	2	C
Sumner ..	15	D	Tarakaipa Island ..	11	B	Te Hauke ..	9	D	Te Wharau ..	10	D
Sumner Lake ..	14	B	Tarakohe ..	12	A	Te Hopa ..	3	D	Thames ..	3	D
Surfdale (Waiheke Is.) ..	3	B	Taranaki Bight North ..	8	A	Te Hopai ..	6	B	Thames Airfield ..	3	D
Surprise Cove ..			Taranaki Bight South ..	8	C	Te Hoe ..	3	C	The Thames ..	3	D
(Lake Manapouri) ..	17	B	Tararu ..	3	D	" ..	4	A	The Bluff ..	5	B
Sutherlands Railway Siding ..	16	D	Tarata ..	8	A	Te Horo ..	10	A	The Bluff ..	20	D
Sutherland Falls. About 13 miles south-west of the Hostel at Head of Milford Sound. (Not incorporated in this map series)			Tarauuni ..	2	D	Te Houka ..	20	B	The Branch ..	13	A
Sutton ..	19	C	Tarawera River ..	5	AB	Te Huahua ..	2	A	The Elms ..	13	D
Swannanoa ..	15	C	Tarawera ..	5	D	Te Huiwai ..	4	A	The Forks ..	17	C
Swanson ..	3	A	Tarawera Lake ..	5	A	Te Kaha ..	6	A	The Gorge (Herekino) ..	2	A
Switzers (Waikaia) ..	20	A	Tarara ..	20	B	Te Kakaho Island ..	11	B	The Key ..	17	B
Table Cape ..	7	D	Tarras ..	18	B	Te Kawa ..	4	B	The Lake (Rotoiti) ..	12	D
Table Flat ..	9	C	Tarewa ..	7	D	Te Kawa West ..	4	B	The Peaks ..	15	A
Table Hill ..	19	D	Tariki ..	8	A	Te Kao ..	1	A	The Plateau (Te Marua) ..	10	C
Tadmor ..	12	B	Taringamotu ..	4	D	Te Karae ..	2	A	The Ramparts ..	17	B
Taemaro ..	1	A	Tarurutangi ..	8	A	Te Karaka ..	7	B	The Reefs ..	18	C
" ..	2	A	Tasman ..	12	B	Te Kauwhata ..	3	C	Thermal District ..	5	A
Tahaenui ..	7	D	Tasman Bay ..	12	B	" ..	4	A	Thermal District ..	5	C
Tahaia ..	4	D	Tasman Downs Station ..	16	C	Tekapo ..	16	C	The Remarkables ..	18	C
Tahakopa ..	20	B	Tatapouri ..	7	D	Tekapo Lake ..	16	AC	The Wolds Station ..	16	C
Tahatika ..	20	B	Tatare ..	17	C	Te Kinga ..	14	A	Thomas Lake ..	17	B
Tahawai ..	6	B	Tataraimaka ..	8	A	Te Kiri ..	8	C	Thorne Bay ..	3	A
Taheke ..	2	A	Tatuanui ..	4	B	Tekoa Station ..	15	A	Thornbury ..	20	C
Tahekeroa ..	3	A	Tatu Junction ..	4	D	Te Kohanga ..	3	C	Thornton ..	5	B
Tahora ..	8	B	Tauaru ..	10	D	" ..	4	A	Thorntons Bay ..	3	D
Tahora Lake ..	2	C	Tauhei ..	3	D	Te Kopuru ..	2	C	Thorpe ..	12	B
Tahora Historic Pa ..	5	B	Tauherenikau ..	10	C	Te Koroa ..	2	A	Tihaka ..	20	C
Tahora Saddle ..	8	B	Tauhoa ..	3	A	Te Kowhai ..	4	A	Tihoi ..	5	C
Tahoraiti ..	10	B	Taumarere ..	2	B	Te Kuiti ..	4	D	Tikinui ..	2	C
Tahuahua Bay ..	11	B	Taumarunui ..	20	B	Te Kuiti Airfield ..	4	D	Tikipunga ..	2	D
Tahunu ..	3	D	Taumata ..	8	D	Te Mahia Bay ..	11	B	Tikitiki ..	6	A
" ..	4	B	Taumatahahi ..	15	D	Te Maire ..	2	C	Tikitere (Hells Gate) ..	5	A
Tahunanui Beach ..	12	B	Taumutu ..	8	D	Te Mania ..	4	D	Tikokino ..	9	C
Taiaroa Head ..	19	BD	Taungatutu ..	8	D	Te Mako Bay ..	11	B	Tikorangi ..	8	A
Taiari (Dunedin) Aerodrome ..	19	D	Taupaki ..	3	A	Te Mania ..	4	AC	Timaru ..	16	D
Taiari Lake ..	19	A	Taupiri ..	3	C	Te Mapara ..	4	D	Timaru Airfield ..	16	D
Taiari Mouth ..	19	D	" ..	4	A	Te Marua (The Plateau) ..	10	C	Timaru Creek Reserve ..	18	A
Taiari Beach ..	19	D	Taupo ..	5	C	Te Mata ..	3	D	Timutimu Head ..	15	D
Taiari Plain ..	19	D	Taupo Airfield ..	5	C	Te Mata ..	4	A	Tinaaruhe ..	7	B
Taiari Plains, Upper ..	19	A	Taupo Lake ..	5	C	Te Maunga ..	5	A	Tiniroto ..	7	C
Taiari River ..	19	ACD	Tauranga ..	5	A	" ..	6	B	Tinline Valley ..	13	A
Taihape ..	9	C	" ..	6	B	Te Mawhai ..	4	B	Tinopai ..	2	C
Taiko Flat ..	16	D	Tauranga Airfield ..	6	B	Te Miro ..	4	B	Tinui ..	10	B
Taikorea ..	10	A	Tauranga Harbour ..	4	B	Te Moleton ..	15	C	Tinwald ..	15	C
Taipa ..	1	A	" ..	5	A	Te Mooka ..	16	B	Tipapakuku ..	10	B
" ..	2	A	Tauranga Harbour Entrance ..	6	B	Te Moana ..	16	B	Tiratu ..	10	B
Taipuha ..	2	D	Tauriko ..	5	A	Te Moari ..	7	C	Tirau ..	4	B
Tairua ..	1	B	" ..	5	A	Te Ngae ..	12	C	Tiraumea ..	10	B
Tairua Harbour ..	1	B	Tauranga ..	2	D	Te Ngawai ..	16	D	Tiriraukawa ..	9	C
Taita ..	10	C	Tauraroa ..	2	D	Tennyson Inlet ..	11	B	Tiritiri Island ..	3	B
Taitapu ..	15	D	Taurikura ..	2	D	Tennyson Lake ..	13	C	Tiroa ..	4	D
Taitumu ..	3	AC	Tautoro ..	2	A	Te Ngutu-o-te Manu ..	8	C	Tirohanga ..	7	A
Takahue ..	2	A	Tautuku ..	20	B	Te Oka ..	15	D	Tirohia ..	3	D
Takahiwi ..	2	D	Tautuku Bay ..	20	B	Te Ore Ore ..	10	D	Tiromoana ..	14	A
Takaka ..	12	A	Tauwhare ..	4	B	Te Pahu ..	4	A	Tira-oro ..	11	B
Takaka Airfield ..	12	A	Tauwhareparae ..	7	B	Te Pangu ..	11	B	Tiroroa ..	14	A
Takaka East ..	12	A	Tawa ..	10	C	Te Papapa ..	3	A	Tirua Point ..	4	C
Takaka Upper ..	12	A	Tawai ..	16	D	Te Piri ..	15	C	Tiroiti Railway Siding ..	19	A
Takanini ..	3	C	Tawanui ..	19	A	Te Poi ..	4	B	Tisbury ..	20	D
Takamatua ..	15	D	Tawataia ..	20	B	Te Pohue ..	9	B	Titahi Bay ..	10	C
Takapu Road ..	10	C	Tawero Point ..	11	B	Te Popo ..	8	A	Titahi Island ..	11	B
Takapuna ..	3	A	Tawhai ..	14	A	Te Pu ..	5	A	Titirangi ..	3	A
Takapu ..	9	C	Tawharanui Point ..	3	B	Te Pua ..	3	A	Titirangi Bay ..	11	B
Takau ..	8	D	Tawharanui ..	3	B	Te Puia ..	7	B	Titoki ..	2	D
Takou Bay ..	2	B	Tawhitini ..	18	D	Te Puke ..	5	A	Ti Tree Point ..	11	A
Tamahere ..	4	B	Tawhitini Island ..	11	B	Te Puna ..	6	B	Toa ..	20	D
Tamaki East ..	3	A	Tawhitini Reach ..	11	B	Te Pungia ..	4	B	Toa Toa ..	7	A
Tamaterau ..	2	D	Tawhiwhi ..	8	D	Te Rahu ..	4	B	Toetoes Bay ..	20	D
Tamumu ..	9	D	Taylor Lake ..	14	B	Te Rapa ..	4	A	Toetoes Harbour ..	20	D
Taneatua ..	5	B	Taylor Pass ..	13	A	Terapatiki ..	7	C	Toiro ..	20	B
Tane ..	10	B	Taylorville ..	14	A	Te Rauamoa ..	4	A	Tokaanu ..	5	C
			Te Ahuahu ..	2	B	Te Rauamau ..	4	C	Tokama ..	15	A
			Te Akau ..	3	C	Terawhiti Cape ..	10	C	Tokanui ..	4	B
					Te Rehunga ..	10	B	Tokanui ..	20	D	
								Tokaora ..	8	C	
								Tokarahi ..	19	A	

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Tokatea	3	B	Umutoaroa	9	C	Waikare Lake	3	C	Waipapa	4	D
Tokatoka	2	C	Umuwheke Bay	11	B		4	A	Waipapa Point	20	D
Tokinima	4	D	Unahi	1	A	Waikare-iti Lake	7	C	Waipapakauri	1	A
	8	B		2	A	Waikaretu	3	C		2	A
Toko	8	C	Upcot	13	A		4	A	Waipapakauri Airfield	1	A
Tokomaru	10	A	Upper Atiamuri	5	C	Waikaremoana (Onepoto)	7	C		2	A
Tokomaru Bay	7	B	Upper Hook	16	D	Waikare Moana Lake	5	D	Waipara	15	A
Tokoroa	5	A	Upper Hutt	10	C		7	C	Waiparera Lake	1	A
Tolaga Bay	7	B	Upper Kawhataau	9	C	Waikari	15	A	Waiparu	20	A
Tomahawk Reef	19	D	Upper Makuri	10	B	Waikato (Port)	3	C	Waipawa	9	D
Tomarata	2	D	Upper Matakikaki	12	D		4	A	Waipatiki	10	B
	3	A	Upper Mohaka	5	D	Waikato River	3	C	Waipiata	19	A
Tom Bowling Bay	1	A		9	A		4	ABD	Waipipi	3	C
Tomona	9	B	Upper Moutere	12	B		5	C	Waipiro	7	B
Tongaporutu	4	C	Upper Riccarton	15	D	Waikawa	20	D	Waipiro Bay	7	C
	8	A	Upper Ruakituri	7	C	Waikawa Bay	11	B	Waipori	19	C
Tongariro	5	C	Upper Taieri Plains	19	A	Waikawa Bay			Waipori Lake	19	D
	8	B	Upper Takaka	12	A	(Queen Charlotte Sound)	11	B	Waipori Falls	19	D
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Tongariro Chateau	8	B	Upper Waiau	7	A	Waikawau	3	D	Waipounamu	20	A
Tongariro National Park	8	B	Upper Waihou	2	A	Waikawau Bay	3	B	Waipu	2	D
	9	A	Upper Waitohi	16	B	Waikeria	4	B	Waipu Beach	2	D
Tophouse Junction	12	D	Urenui	8	A	Waikerikeri Bay	15	D	Waipu Cove	2	D
Tophouse Airfield	12	D	Urewera Country	5	BD	Waikiekie	2	D	Waipuku	8	A
Topuni	2	D		7	A	Waikino	3	D	Waipukurau	9	D
Torbay	3	A	Urewera National Park	5	BD	Waikiwi	20	C	Waipukurau Airfield	9	D
Torea Bay	11	B		7	AC	Waikohu	7	A	Waipururu	9	C
Torehape	3	D	Ururupakapuka Island	2	B	Waikokopu	7	D	Wairakei	5	C
Torere	7	A	Urrall	15	C	Waikokowhai	3	C	Wairamarama	3	C
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Totara	19	B	Uruti Point	10	D	Waikoiko	20	B	Wairangi	11	B
Totara Flat	14	A	Uruwhenua Bridge	12	A	Waikonini	9	A	Wairarapa Lake	10	C
Totara North	2	B	Utakura	2	A	Waikorea	3	C	Wairata	7	A
Totara Reserve (Ashhurst)	10	B	Utiku	9	C		4	A	Wairau River	13	AC
Totara Valley	16	D	Utuwai	9	C	Waikouaiti	19	B	Wairau Valley	13	A
Totaranui	12	A	Uxbridge	19	A	Waikourou Railway Siding	20	C	Waireia	2	A
Towai	2	B				Waikuku	15	A	Waireka	5	A
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Traquair	19	D	Victoria Valley	2	A	Waima	2	A	Wairo	20	C
Trantham	10	C	View Hill	15	C	Waima	7	B	Wairoa	7	C
Tripp Lake	16	A	Vinegar Hill	18	B	Waimahaka	20	D	Wairoa (Buried Village)	5	A
Trounson Kauri Park	2	C				Waimai	3	C	Wairoa Gorge	12	B
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Tuai	7	C	Wadestown	10	C	Waimangaroa	12	C	Waitaha	14	C
Tuakau	3	C	Waerenga	3	D	Waimangu	5	A	Waitahanui	5	C
Tuakitoto Lake	19	D		4	A	Waimana	5	B	Waitahinga	8	D
Tuamarina	13	A	Waerengaahika	7	BD	Waimarie	12	C	Waitahora	10	B
Tuapeka Flat	19	C	Waeranga-o-Kuri	7	D	Waimata	6	B	Waitahuna	19	D
Tuapeka Mouth	19	C	Wahanui	7	C	Waimata	7	B	Waitahuna Gully	19	D
Tuapeka West	19	C	Wahapo Lake	17	C	Waimate	16	D	Waitakaro	7	B
Tuatapere	20	C	Wahi Lake	3	C	Waimate North	2	B	Waitakaruru	3	D
Tuhara	7	C		4	A	Waimatenui	2	A	Waitakere	3	A
Tuhikaramaea	4	A	Waharoa	4	B	Waimatua	20	D	Waitakere Scenic Drive	3	A
Tuhipa	2	B	Waharoa Airfield	4	B	Waimatuku	20	C	Waitaki Bridge	16	D
Tui	12	D	Waianakarua	19	B	Waimarama	9	D	Waitaki Airfield	19	B
Tui Glen	3	A	Waianakarua Airfield	19	B	Waimarino (National Park)	8	B	Waitaki River	18	B
Tukemokihi	7	C	Waianiwa	20	C	Waimauku	3	A		16	D
Tukituki River	9	BD	Waiare	2	B	Waimaunga Railway Siding	14	A		19	A
Tumahu	8	C	Waiareka Junction	19	B	Waimaea West	12	B	Waitane	20	B
Tumai	19	B	Waiariki	20	B	Waimiha	4	D	Waitangi	3	A
Tuna	8	A	Waiaruhe	10	B	Waimiro	10	B	Waitangi Reserve	2	B
Tuna Bay	11	B	Waiatoto	17	A	Waimotu Railway Siding	19	B	Waitanguru	4	C
Tunakino Valley	13	A	Waiatu Pa	3	C	Waimumu	20	B	Waitapu	12	A
Tunakotekote	4	D	Waiatu Upper	15	A	Waingake	7	D	Waitara	8	A
Tunawhakapeke Lake	4	B	Waiatu	13	D	Waingaro	3	C	Waitarakao Lagoon	16	B
Tungara Cove	9	D	Waiatu River	17	B		4	A	Waitarere Beach	10	A
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Turakina	10	A	Waiata Lower	7	A	Wainui	2	B	(Kenepuru Sound)	11	B
Turakina River	8	D	Waiata Upper	7	A	Waimui	3	A	Waitaruke	2	B
	9	C	Waihao Downs	16	D	Waimui	7	D	Waitata Bay (Pelorus Sound)	11	B
	10	A	Waihao Forks	16	D	Waimui	15	D	Waitati	19	D
Turakirae Head	10	C	Waihapai	8	D	Waimui Inlet	12	A	Waitawheta	3	D
Turangamoana	4	B	Waihaurunga	16	D	Wainui Junction	2	A	Waitawa Railway Siding	16	B
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Turner Lake	17	A	Waihi Beach	3	D	Waiohiki	9	B	Waitete	4	D
Turoto	4	D	Waihi Village	5	C	Waiomatatini	6	A	Waitetoko	5	C
Turua	3	D	Waihinau Bay (Pelorus Sound)	11	B	Waiomio	2	B	Waitetuna	4	A
Turuturu-Mokai	8	C	Waihirere	7	B	Waiomiu	3	D	Waitiri	18	D
Tussock Creek	20	C	Waihoaka	19	D	Waione	10	B	Waitoa	4	B
Tutaetaka Island	6	B	Waihola	20	C	Waione Railway Siding	4	D	Waitohi Flat	16	B
Tutaki	12	D	Waihola Lake	19	D	Waiongona	8	A	Waitohi Plains	15	A
Tutamoe	2	A	Waihopo	1	A	Waioururangi	13	D	Waitohi Upper	16	B
Tutekehua	2	A	Waihou	3	D	Waiorongomai	4	B	Waitoitoi	3	B
Tutira Lake	5	D		4	B	Waiotahi	5	B	Waitoitoi	3	A
	9	B	Waihou Upper	2	A	Waiotahi Valley	5	B	Waitoki	3	A
Tutira Railway Station	5	D	Waihua	7	C	Waiotapu	5	A	Waitomo	4	CD
Tutukaka	2	D	Waihue	2	C	Waiotemarama	2	A	Waitomo Caves	4	C
Tuturau	20	B	Waihuka	19	D	Waiotira	2	D	Waitotara	8	D
Tututawa	8	A	Wai-iti	12	B	Waiotu	2	D	Waitotara Railway Station	8	D
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			Waikaka	20	B	Waipa	4	D	Waitui Bay	11	B
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Waiwhare	9	A	Westerfield	15	C	Whangarei Heads	2	D	Whitford	3	AC
Waiwiri Lake	10	A	West Eyreton	15	C	Whangaripo	3	B	Whitmore	10	A
Wakanui	15	C	Westfield	3	A	Whangaroa	2	B	Whitstone	19	AB
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Wakefield	12	B	West Melton	15	C	Wharanui	13	B	Willowbank	20	B
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Wallacetown	20	C	Westmere	10	D	Whare Flat	19	D	Willowbridge	16	D
Wallaceville	10	C	Weston	19	B	Wharehine	3	A	Willow Flat	5	D
Wallingford	9	D	West Oxford	15	C	Wharehuanui	18	C	Willmot Lake	17	A
Wallsend	14	A	West Plains	20	C	Wharekaka	7	B	Wilson Bay (Pelorus Sound) ..	11	B
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Wanaka Lake	18	A	Westshore	9	B	Whareorino	4	C	Wimbledon	11	A
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Wangapeka	12	D	Whakamaru	5	C	Wharfedale Station	15	A	Wiri	3	C
Wangapeka Valley	12	C	Whakapara	2	D	Wharua	19	A	Woodbury	16	B
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Ward Island	10	C	Whakataki	11	A	Whataroa	16	A	Woodend	20	D
Wardville	4	B	Whakatane	5	B	"	17	C	Woodgrove	15	A
"	6	B	Whakatane West	5	B	Whataroa Airfield	16	A	Woodhill	3	A
Warea	8	C	Whakatiwai	3	D	"	17	C	Woodlands	5	B
Warepa	20	B	Whakatu	9	B	Whatatutu	7	A	"	7	A
Warkworth	3	A	Whaleback Station	16	C	Whatawhata	4	A	Woodlands	20	D
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Warrington	19	D	(Tory Channel)	11	B	Whatoro	2	C	Woods Bay	3	D
Warwick Junction	12	D	Whalesback	13	D	Whatuwhiwhi	1	A	Woodside	10	C
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Wedderburn	19	A	Whangamata	3	D	Whenuakura	8	D	Woolston	15	D
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Wehenga	19	D	Whangamoa	12	B	Whenuapai Aerodrome	3	A	Wrights Bush	20	C
Weka Pass	15	A	Whanga Moana	10	C	"	9	C	Wyles Crossing	19	D
Wekaweka	2	A	Whangamomona	8	B	Whetukura	2	A	Wyndham	20	B
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Wellington (Paraparaumu) ..			Whangapara Roads	6	A	Whitehills	3	A	ates Point (Milford Sound) ..	17	A
Aerodrome	10	C	Whangape	2	A	White Island	5	B	Yncya (Pelorus Sound) ..	11	B
Wellsford	3	A	Whangape Harbour	2	A	White Island	19	D	Young Nicks Head	7	D
Wendon	20	A	Whangape Lake	3	C	White Rock	10	D			
Wendonside	20	A	"	4	A	White Rock	15	A			
Wendon Valley	20	A	Whangapoua	1	B	Whites Bay	13	A	Zane Grey Camp	2	B
									(Urupukapuka Island) ..		

CITY OUTLET MAPS: Auckland and Wellington preceding page 1.
Christchurch and Dunedin following page 20.

MAIN LAKES.

(All lakes are shown alphabetically in the general Index.)

NORTH ISLAND—

- LAKE ROTO RUA. 925 feet above sea level. Good trout fishing, principally rainbow trout. Township of Rotorua situated at southern extremity of lake. Centre of thermal region containing geysers, boiling pools, mud-volcanoes, mineral springs and healing waters; modern establishment for spa treatment 5 A
- LAKE TARAWERA. 1,032 feet above sea level. Good view across the lake to Mount Tarawera. Angling and shooting. Launch excursions 5 A
- LAKE TAUPO. Largest lake in New Zealand. 1,180 feet above sea level. Area 240 square miles. Deepest part 535 feet. World reputation for trout fishing, principally rainbow trout. Principal source of Waikato River supply for main hydro-electric schemes. Township of Taupo situated on northern shore. Thermal district. Wairakei and Geyser Valley 6 miles north has extraordinary thermal activities; geysers, boiling cauldrons, steam vents, dancing rock, and petrifying springs. Medicinal baths 5 C
- LAKE WAIKAREMOANA. About 2,000 feet above sea level. Area 21 square miles. Deepest part 846 feet. Good scenery and waterfalls. Source of water for hydro-electric power house. Lake House Hotel on north-eastern shore .. 7 C

The Great Southern Lakes.

NOTABLE MOUNTAIN PEAKS

Main Peaks:

Mount Alba	8,268 feet	..	..	..	..	17	A
" "		..	..	..	..	18	A
Mount Aspiring	9,975 feet	..	..	..	..	17	A
" "		..	..	..	..	18	A
Mount Castor	8,286 feet	..	..	..	..	17	A
Mount Cook	12,349 feet.	Highest	in	N.Z.		16	A
Mount de la Beche	10,040 feet	..	..	..	..	16	A
Mount Earnslaw	9,165 feet	..	..	..	..	17	A
Mount Edward	8,680 feet	..	..	..	..	17	A
" "		..	..	..	..	18	C
Mount Elie de Beaumont	10,176 feet	..	..	..	..	16	A
Mount la Perouse	10,090 feet	..	..	..	..	16	C
Mount Malte Brun	10,420 feet	..	..	..	..	16	A
Mount Pollux	8,341 feet	..	..	..	..	17	A
Mount Sealy	8,651 feet	..	..	..	..	16	C
Mount Sefton	10,350 feet	..	..	..	..	16	C
Mount Tasman	11,467 feet	..	..	..	..	16	A
Mount Tapuaenuku	9,465 feet ; visible	from					
North Island in clear weather		..	..	..	..	13	B
Tutoko Peak	9,042 feet	..	..	..	..	17	A

Glacier Region:

Burton Glacier	..	..	..	..	..	16	A
Douglas Glacier	..	..	..	..	..	16	C
Fox Glacier	..	..	..	..	..	16	A
Franz Josef Glacier	..	..	..	..	..	16	A
Godley Glacier	..	..	..	..	..	16	A
Hooker Glacier	..	..	..	..	..	16	AC
Mount Cook Hermitage. Accommodation centre ; 2,500 feet above sea level. Winter sports. Tourist and all-the-year round holiday resort							
						16	C
Mueller Glacier	..	..	..	..	..	16	C
Murchison Glacier	..	..	..	..	..	16	A
Spa Glacier	..	..	..	..	..	16	A
Spencer Glacier	..	..	..	..	..	16	A
Tasman Glacier	..	..	..	..	..	16	AC



(Marlborough Sounds: 1 inch = 8 miles)

SCALE OF MILES

0 5 10 15 20 25



(Havelock)

SEE PAGE 13

(Blenheim)

D

SEE PAGE 14

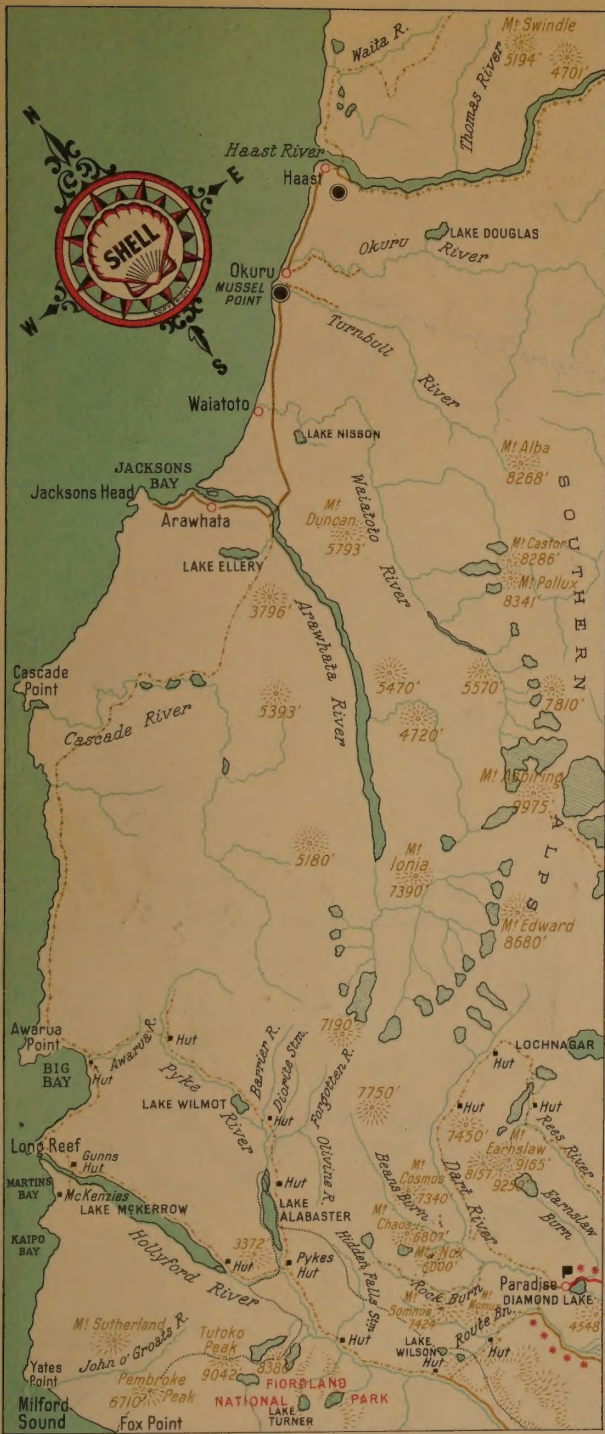
(Springs Junction)











SEE PAGE 18

SEE PAGE 18

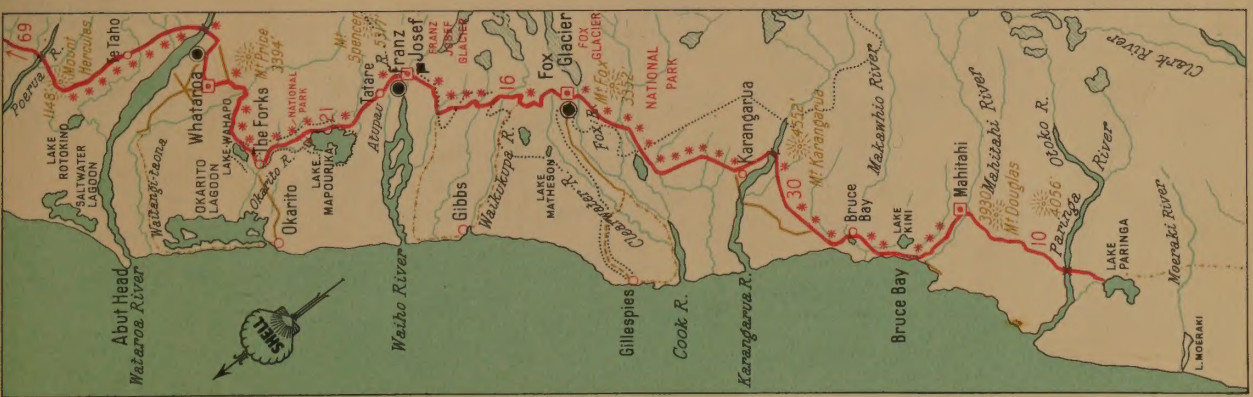


SEE PAGE 20

(Ohaupo)

(Haast)

SEE PAGE 14 (Hokitika)



(Haast)









CHRISTCHURCH, the City of the Plains, has as its dominating architectural feature the Anglican Cathedral, the finest Gothic style church in the Dominion. The Cathedral choir, which has received high praise from overseas critics, sings at all services, including mid-week evensong. From the tower balcony of the Cathedral there is a commanding view of the city.

Canterbury University College, also built in Gothic style, is opposite the Botanical Gardens. Nearby is Christ's College (modelled on the English Public School) which has fine buildings set in spacious surroundings. Hagley Park is a reserve of nearly 500 acres within five minutes' walk of Cathedral Square (the centre of the city). All sports are played on this park area and the River Avon meanders through it providing some beautiful walks.

Sign of the Takahe, an imposing stone building at the Cashmere Hills terminus, commands a magnificent view of the city and plains. Following the style of a baronial hall, it is noted for its heraldic carvings.

The railway connecting the port at Lyttelton via a long tunnel through the hills was constructed in the 1860's and was the first New Zealand major railway undertaking.



DUNEDIN is the "Edinburgh of the South". In fact the word "Dunedin" was the ancient name for Edinburgh. The Scottish origin of the first settlers is preserved in many street names and in the evidence of respect for education. The University of Otago was New Zealand's first university and today its imposing buildings mark Dunedin in a true and rare sense as a "university town". Other architectural features include the stately St. Paul's Cathedral, in front of which stands a statue memorial to Robert Burns, and First Church, a building of exceptional beauty erected by the early settlers. The Otago Museum is noted for its Polynesian collection which is one of the best in the world.

There are two excellent beaches at St. Kilda and St. Clair. Many fine views of the city and its surroundings can be obtained from vantage points on Highcliff Road, Signal Hill, Flagstaff Road and Look Out Point.

The deep sea harbour outlet for the province is at Port Chalmers, a pleasant and picturesque town nine miles from the centre of Dunedin.



SHELL X-100 MOTOR OIL—All Normal Grades
AND MULTIGRADES 10W/30 AND 20W/40

SOUTH ISLAND MILEAGE CHART ■ SHORTEST MAIN ROUTES ■ To nearest mile



	ALEXANDRA	ARTHURS PASS	ASHBURTON	BALCLUTHA	BLENHEIM	CHRISTCHURCH	CLARKSVILLE	CROMWELL	CULVERDEN	DARFIELD	DUNEDIN	FAIRLIE	GERALDINE	GREYMOOUTH	INANGAHUA JCT.	INVERCARGILL	KAIKOURA	KYEBURN	LEWIS PASS	LUMSDEN	MANAPOURI	MILFORD HOSTEL	MOUNT COOK	MURCHISON	NELSON	OMARAMA	OTIRA	PALMERSTON	PICTON	PUKAKI	QUEENSTOWN	RAKAIA	REEFTON	ROXBURGH	TE ANAU	TEKAPO	TIMARU	WAIHO (Franz Josef)	WAIMATE	WAIKARA	WESTPORT			
ALEXANDRA	●	351	242	100	491	296	88	20	357	293	126	229	219	166	411	515	479	172	411	66	415	124	173	260	171	512	564	143	109	360	106	509	134	56	260	457	28	186	163	197	490	173	334	470
ARTHURS PASS	351	●	139	331	284	87	319	330	150	58	281	160	132	380	60	245	133	420	204	285	153	422	471	558	253	166	247	208	241	9	245	302	216	357	121	111	380	459	187	154	149	182	124	120
ASHBURTON	242	139	●	222	249	53	210	231	117	81	172	84	35	271	199	273	237	311	169	176	173	313	375	462	154	270	322	99	142	148	136	267	117	258	18	250	269	375	88	45	256	73	89	269
BALCLUTHA	100	331	222	●	471	276	12	120	337	273	50	216	199	49	391	495	459	89	391	126	395	91	140	227	261	492	544	123	199	340	86	490	273	156	240	437	73	165	243	177	485	154	311	489
BLENHEIM	491	284	249	471	●	197	459	510	147	226	421	310	287	520	260	24	187	560	80	425	205	562	611	674	408	154	73	348	396	293	385	18	371	512	234	209	518	611	342	294	373	322	160	217
CHRISTCHURCH	296	87	53	276	197	●	264	268	63	29	226	115	86	325	147	221	185	365	117	230	121	367	410	485	208	218	270	153	200	96	190	215	171	325	35	163	321	410	145	99	253	125	37	215
CLARKSVILLE	88	319	210	12	459	264	●	108	325	261	38	204	187	61	379	483	447	101	379	114	383	103	152	215	249	480	532	111	187	328	74	477	212	171	225	425	61	140	231	165	474	142	299	439
CROMWELL	20	330	231	120	510	268	108	●	390	311	146	209	237	146	429	534	512	154	430	86	448	104	153	216	151	545	597	162	89	378	125	528	114	36	290	490	47	141	243	216	524	193	364	510
CULVERDEN	357	150	117	337	147	63	325	390	●	92	287	181	153	386	151	171	122	426	67	291	58	428	477	540	274	155	220	214	262	159	251	165	237	378	100	100	386	478	208	160	264	188	26	152
DARFIELD	293	58	81	273	226	29	261	311	92	●	223	102	74	322	118	250	191	362	146	227	150	364	413	488	195	224	299	150	183	67	187	244	158	299	66	169	322	413	129	96	224	124	66	178
DUNEDIN	126	281	172	50	421	226	38	146	287	223	●	166	149	99	341	445	409	139	341	76	345	141	190	265	211	442	494	73	149	290	36	439	174	182	187	387	99	190	193	127	447	104	261	401
FAIRLIE	229	160	84	216	310	115	204	209	181	102	166	●	29	265	220	339	293	305	235	170	239	265	314	389	93	326	388	93	81	169	130	333	56	197	81	271	218	314	27	40	326	67	155	282
GERALDINE	219	132	35	199	287	86	187	237	153	74	149	29	●	248	192	311	265	288	207	153	211	290	339	414	121	298	360	76	109	141	113	305	84	225	53	243	248	318	55	22	298	50	127	252
GORE	166	380	271	49	520	325	61	146	386	322	99	265	248	●	440	544	508	40	440	175	444	42	91	154	288	541	593	172	226	389	135	538	251	110	286	486	122	79	280	226	546	203	360	500
GREYMOOUTH	411	60	199	391	260	147	379	429	151	118	341	220	192	440	●	236	73	480	218	345	93	482	531	605	313	106	187	268	301	51	305	278	276	417	184	51	440	530	247	214	113	242	177	60
HAVELOCK	515	245	273	495	24	221	483	534	171	250	445	339	311	544	236	●	163	584	104	449	227	586	635	709	432	130	49	372	420	287	409	42	395	536	258	185	542	635	366	318	349	346	184	193
INANGAHUA JCT.	479	133	237	459	187	185	447	512	122	191	409	293	265	508	73	163	●	550	189	413	64	550	599	673	386	33	114	336	374	124	373	205	349	490	219	22	508	599	320	282	186	310	148	30
INVERCARGILL	172	420	311	89	560	365	101	154	426	362	139	305	288	40	480	584	550	●	480	215	484	50	99	174	296	581	633	212	234	429	175	578	259	118	329	526	162	98	288	586	243	400	578	
KAIKOURA	411	204	169	391	80	117	379	430	67	146	341	235	207	440	218	104	189	480	●	345	125	482	543	606	328	222	153	268	316	213	305	98	291	427	154	167	440	531	262	214	331	242	80	219
KYEBURN	66	285	176	126	425	230	114	86	291	227	76	170	153	175	345	449	413	215	345	●	349	209	258	333	215	451	498	77	153	294	40	443	178	141	194	391	93	238	197	131	451	108	265	405
LEWIS PASS	415	153	173	395	205	121	383	448	58	150	345	239	211	444	93	227	64	484	125	349	●	486	535	610	345	97	178	272	320	144	309	223	295	436	158	42	444	535	266	218	206	246	84	94
LUMSDEN	124	422	313	91	562	167	103	104	428	364	141	265	290	42	482	586	550	50	482	209	486	●	49	124	246	583	635	214	184	431	177	580	209	68	331	528	151	49	238	268	591	245	402	542
MANAPOURI	173	471	375	140	611	410	152	153	477	413	190	314	339	91	531	635	599	94	543	258	535	49	●	87	295	632	684	263	233	480	226	629	258	117	380	577	200	13	287	317	637	294	451	601
MILFORD HOSTEL	260	558	462	227	674	485	215	216	540	488	265	389	414	154	605	709	673	174	606	333	610	124	87	●	370	707	759	358	308	555	301	692	333	192	455	652	275	75	362	392	712	369	526	666
MOUNT COOK	171	253	154	261	408	208	249	151	274	195	211	93	121	288	313	432	386	296	328	215	345	246	295	370	●	416	481	138	62	262	175	426	37	178	174	374	198	295	66	132	419	160	248	373
MURCHISON	512	166	270	492	154	218	480	545	155	224	442	326	298	541	106	130	33	581	222	451	97	583	632	707	416	●	81	369	407	157	406	172	382	523	252	55	541	632	353	315	219	343	181	63
NELSON	564	247	322	544	73	270	532	597	220	299	494	388	360	593	187	49	114	633	153	498	178	635	684	759	481	81	●	421	469	238	458	91	444	585	304	136	593	684	415	367	300	395	233	144
OMAMARU	143	208	99	123	348	153	111	162	214	150	73	93	76	172	268	372	336	212	268	77	272	214	263	358	138	369	421	●	76	217	37	366	101	192	117	314	172	263	120	54	374	31	188	366
OMARAMA	109	241	142	199	396	200	187	89	262	183	149	81	109	226	301	420	374	234	316	153	320	184	233	308	62	407	469	76	●	250	113	414	25	116	162	362	137	233	54	121	407	107	236	361
OTIRA	360	9	148	340	293	96	328	378	159	67	290	169	141	389	51	287	124	429	213	294	144	431	480	555	262	157	238	217	250	●	254	310	225	366	133	102	389	480	196	163	157	191	133	111
PALMERSTON	106	245	136	86	385	190	74	125	251	187	36	130	113	335	305	409	373	175	305	40	309	177	226	301	175	406	458	37	113	254	●	403	138	161	154	351	135	226	157	91	411	68	225	365
PICTON	509	302	267	490	18	215	477	528	165	244	439	333	305	538	278	42	205	578	98	443	233	580	629	692	426	172	91	366	414	310	403	●	389	530	252	227	536	629	360	312	391	340	178	235
PUKAKI	134	216	117	273	371	171	212	114	237	158	174	56	84	251	276	395	349	259	291	178	295	209	258	333	37	382	444	101	25	225	138	389	●	141	137	337	162	258	29	96	382	123	211	336
QUEENSTOWN	56	357	258	156	512	325	171	36	378	299	182	197	2																															



NATIONAL AND PROVINCIAL TRUNK HIGHWAY SYSTEMS

NATIONAL (Red Shield) 1
 PROVINCIAL (Blue Square) 67

The numbers or colours do not necessarily mean one highway is better than another.
 For importance of motoring routes see detailed map pages.



SHELL PRODUCTS



Shell Motor Spirit with ICA
Big Tree Motor Spirit
Shell X-100 Motor Oils
Shell X-100 Multi-grade Motor Oils
Shell 2T Two Stroke Motor Oil
Shell Spirax and Dentax Gear Oils
Shell Retinax Automotive Greases — for chassis and steering lubrication, wheel bearings, universal joints, water pumps, springs, grease cups, tractor tracks
Shell Retinax K Dry Stick Lubricant
Shell Donax Automotive Specialties — shock absorber oils, brake fluid, anti-corrosion oil for radiators, flushing oils, handy oil, spring spray oil, rubber lubricant, pre-selector gear oil, fluid drive oil, and upper cylinder lubricant
Shell Ensis Oil 20 — for the protection of laid-up engines
Shell Diesel Engine Oils
Shell Anti-Freeze for Radiators
Shell Aviation Fuels and AeroShell Lubricants
Shell Marine Lubricants and Bunker Fuels
Shell Racing Spirits
Cross Power Kerosine
Shell Blue Pennant Household Kerosine —
for lighting, heating and cooking — the safe Kerosine
Shellite — for petrol-burning lamps, cookers, etc.
Shell Diesoline Shell Diesel Fuel
Shell Fuel Oil Shell Furnace Oil
Shell Range Oil
Shell Industrial and Agricultural Oils and Greases
Corrosion Preventives Shell Petrolatums
"Cariflex" Synthetic Rubber
Hydrocarbon and Chemical Solvents
Shell Mineral Turpentine
Shell White Spirit and Dry Cleaning Aids
Shelltox Fly Spray
Shell Spraying Oils — certified by the Plant Diseases Division, D.S.I.R.
Shellestol "H" — a wetting and spreading agent for water-base sprays
Shell D.D. and Nemagon Soil Fumigants
Shell Defiance Blowfly Oil
Aldrin, Dieldrin and Endrin Insecticides
Weedkillers and other Agricultural Chemicals
Phosdrin
"Epikote" Resins
Shell Delak No. 2 Dairy Cleaner
"Teepol" and "Nonidet" detergents
Shell Lighter and Cleaning Fluid
Shell Handy Oil Shell Bicycle and Lawnmower Oil
Bitumex Paint
Colas and Colasmix — for paths, drives and tennis courts
Flintkote — for flooring and roof coverings and for the protection of vehicle chassis
Bitumen Cutbacks and Road Oils
Paraffin Wax

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SOUTH ISLAND TRAVEL TIME MAP

Use this map to plan your driving—avoid fatigue and accidents.

Based on: Actual driving times for a driver who travels at 45 to 50 m.p.h. on open stretches of road. **Plus** a safety factor of 5 to 10 minutes per hour for short refreshment stops or minor traffic delays.

Slower Drivers: The times also approximate the driving time (with no safety factor) for a driver who travels at about 40 m.p.h. on open stretches of road. Allow an extra 10 minutes per hour for safety.

Holiday Allowance: In heavy holiday or Sunday traffic allow an extra 15-20 minutes on roads approaching the main centres.

Meals: Allow an extra hour for meals on long trips (say over 5 hours).

Refreshments: Make a practice of stopping for a short rest and a cup of tea every couple of hours at least—this combats fatigue.

Tired Drivers Cause Accidents: So don't keep on driving when you are tired. Pull off the road and have a spell. On long trips share the driving if you have another driver as a passenger. Normally don't plan on more than eight hours' driving a day if you do it all yourself.

(See inside front cover for North Island Travel Time Map)

